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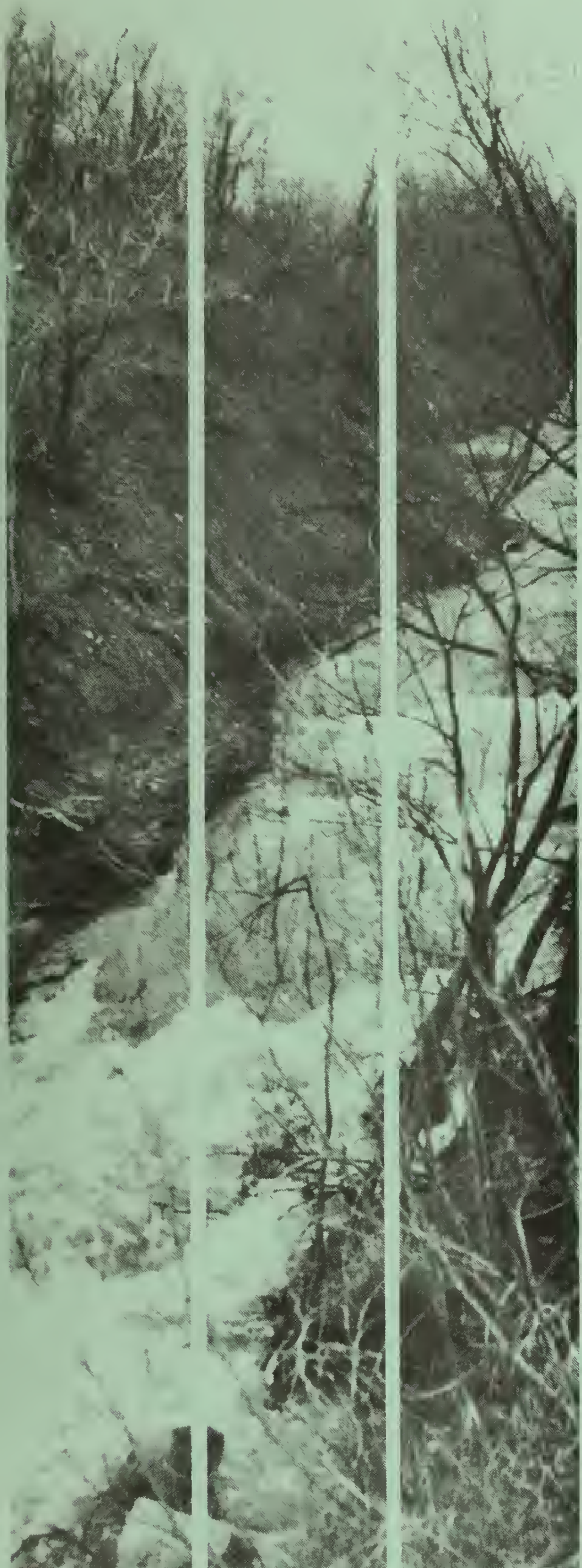

A Guide to the Geology of the Morris Area

David L. Reinertsen

Field Trip 1984 - B
May 19, 1984
Department of Energy and Natural Resources
STATE GEOLOGICAL SURVEY DIVISION
Champaign, Illinois 61820

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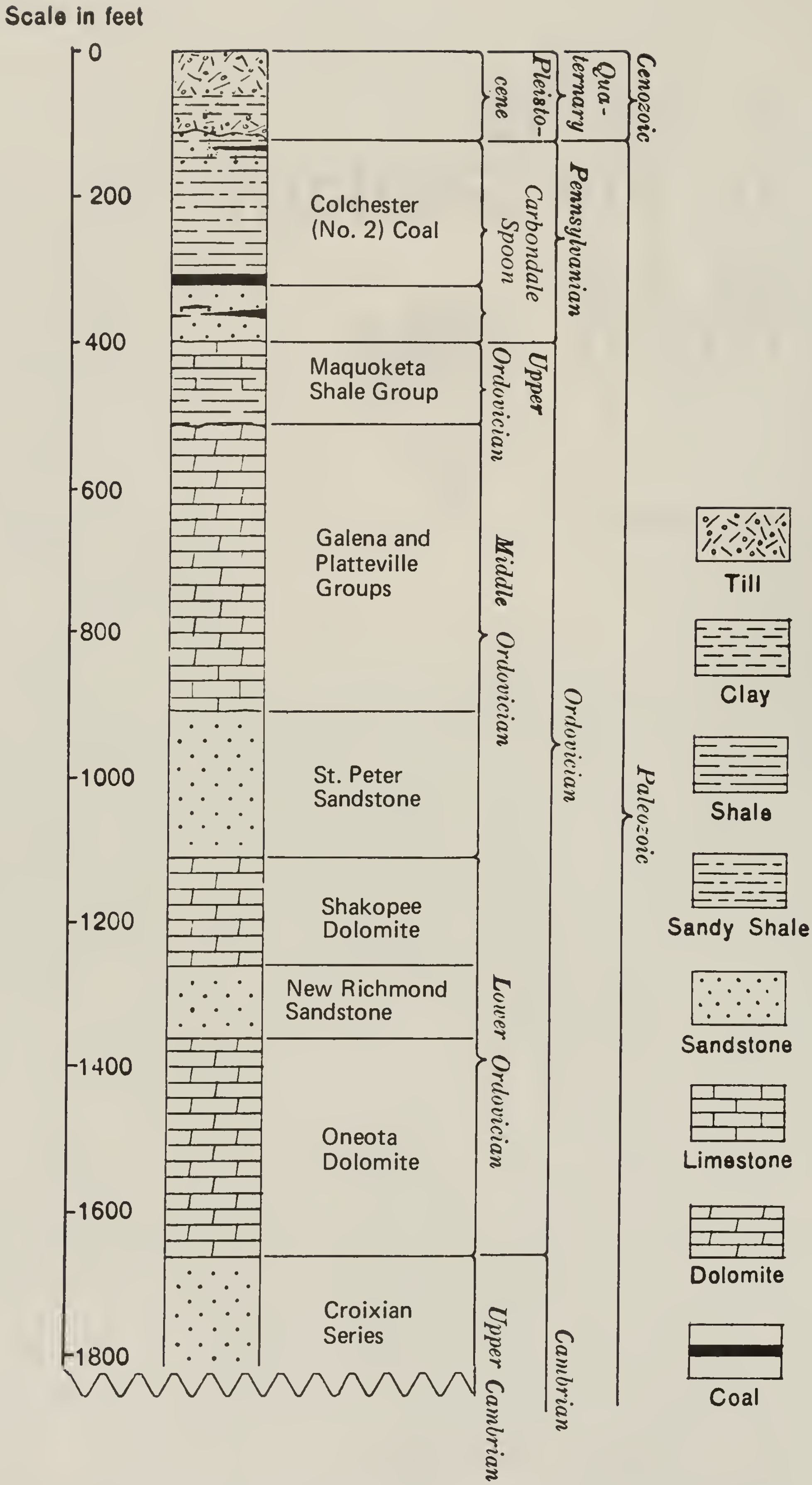


FIGURE 1. Generalized columnar section of the rocks of the Morris Quadrangle.

the geologic framework

Morris lies beside the Illinois River in a broad basin that occupies most of Grundy County and is part of the Kankakee Plain (see The Physiographic Divisions of Illinois, appendix). The field trip highlights some of the features of the glacial deposits and bedrock of the Morris Basin, the prominent, glacially-formed ridges (moraines) that border the basin on the west, north and east and some facilities constructed along the Illinois River.

The Morris area was covered by thick continental glaciers during the "Great Ice Age" (Pleistocene Epoch) that lasted nearly a million years and ended only 10 thousand years ago. The glacial ice and associated meltwaters left various deposits that cover the much older bedrock. These deposits range from a hundred to a few feet thick in the Morris area. Although early glaciers (Kansan and Illinoian) (see Pleistocene Appendix) doubtless covered the area, most of the glacial deposits (drift) visible at the surface in Grundy County are between 22,000 and 12,500 years old and were deposited by glaciers of the Wisconsinan stage.

Glacial lakes occupied parts of the Morris Basin during much of this time and are responsible for the general flatness of the area. The lakes were formed by the meltwater that ponded between the high moraines (Marseilles Morainic System) just west and north of Grundy County and the glacier melting back to the east. The deposits in these lakes consist of finely-layered clays and silts, beach sands and gravels, and coarse rubble bars. A period of relatively rapid melting (when the front of the glacier had retreated approximately to the position of present Lake Michigan) produced torrential flooding down the Kankakee River and development of a large lake—Lake Wauponsee—that covered most of Grundy and Kankakee Counties. Coarse rock debris litters the plain of Lake Wauponsee.

In the hummocky morainal area at the west, the glacial deposits consist of mixed clay, silt, sand, pebbles, and boulders laid down directly by the ice. This material is called till. Another common glacial deposit, transported and laid down by flowing meltwater is outwash—sorted sand and gravel. Outwash is commonly found along glacial valleys as valley trains and in front of moraines where meltwater flowed away from the ice (outwash plains).

The bedrock that underlies the glacial deposits in the Morris area consists of about 4,000 feet of sedimentary strata (figs. 1 and 2). These strata are mostly shale, limestone, dolomite, and sandstone deposited as loose sediments, layer upon layer, in shallow seas that covered the Midcontinent Region during the Paleozoic Era between 570 and 225 million years ago. The Paleozoic is divided into major subdivisions of rocks known as systems, each of which was

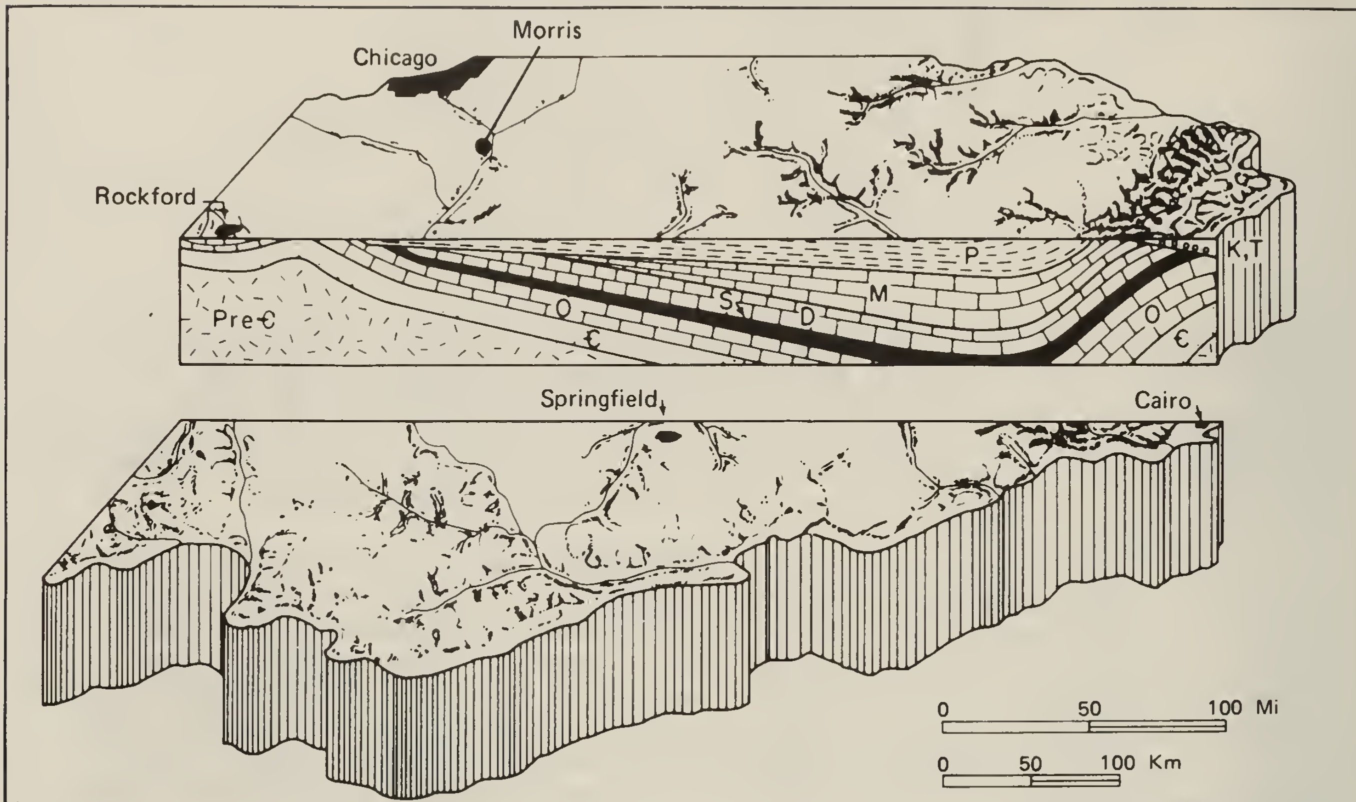


FIGURE 2. Stylized north-south cross section shows the structure of the Illinois Basin. In order to show detail, the thickness of the sedimentary rocks has been greatly exaggerated and the younger, unconsolidated surface deposits have been eliminated. The oldest rocks are Precambrian (Pre-C) granites. They form a depression that is filled with layers of sedimentary rocks of various ages: Cambrian (C), Ordovician (O), Silurian (S), Devonian (D), Mississippian (M), Pennsylvanian (P), Cretaceous (K), and Tertiary (T). The scale is approximate.

deposited during a specific period of geologic time. The systems are further subdivided into many formations.

Bedrock exposed in stream and roadcuts and quarries in the area belongs to the Pennsylvanian and Ordovician Systems of rocks. Formations of Silurian and Cambrian age are known to be present in the subsurface. The Cambrian rocks rest on ancient Precambrian igneous and metamorphic rocks that are more than a billion years old. In northern Illinois there is no record in the rocks of the time between formation of the youngest bedrock (Pennsylvanian System—270 million years ago) and the beginning of continental glaciation (Pleistocene Epoch—1 million years ago). The area was apparently above sea level and erosion prevailed over deposition.

The Pennsylvanian rocks (sometimes called the Coal Measures) were formed in shallow seas and bordering deltaic swamps that repeatedly occupied much of Illinois. Coals within the Pennsylvanian rocks were formed by the accumulation of plant material (usually where it grew) beneath the quiet waters of extensive swamps that prevailed for long intervals of time. Lush forest vegetation, which thrived in the warm, moist Pennsylvanian climate, covered the region. Plant fossils are commonly found associated with the coal.

Ordovician rocks exposed in the Morris area belong to the Maquoketa and Galena-Platteville Groups and are more than 435 million years old. They were deposited in seas that covered probably all of Illinois. Ordovician rocks are one of the most widespread systems of rocks in the world.

Mineral resources of the area include coal, limestone and dolomite, sand and gravel, and clay. The coal formerly mined in eastern Grundy and western Will Counties is the Colchester (No. 2) Coal Member, the most extensive coal in the state, covering virtually all of the 35,000 square miles of coal-bearing rocks. In the Morris Basin, the coal is shallow enough to be mined by surface methods, which accounts for the many square miles of spoil piles and shallow lakes visible between Morris and Wilmington. The area has been famous as a collecting ground for plant fossils.

The underclay beneath the No. 2 Coal is used as a source of ceramic clay. Deposits of Goose Lake Clay, a short distance to the west, have been mined for the manufacture of ceramic materials, especially fire brick.

Limestone and dolomite from the Galena-Platteville Group and Pleistocene sands and gravels are also mined in the area.

Water is another resource of the Morris area. The Illinois Waterway is a major transportation route and a source of water for various purposes. The Dresden Nuclear Power Plant of Commonwealth Edison is situated at the junction of the Des Plaines and Kankakee Rivers. Water for the cooling lake is taken from the river. Cooling water for the Commonwealth Edison Nuclear Power Station near Braidwood will be recirculated from a large artificial lake covering part of the strip mine spoil area.

The Illinois and Michigan Canal was constructed in the 1830s and 40s to connect Lake Michigan and the Illinois River. The low ground along the Chicago and Des Plaines Rivers provided the upper cource of the canal.

guide to the route

Miles to next point	Miles to starting point	
		Head east along the north driveway of Morris High School just west of the stop sign (SE¼ SE¼ NW¼ Sec. 4, T. 33 N., R. 7 E., 3rd P. M., Grundy County; Morris 7.5-minute Quadrangle).
		Several mine dumps from the 1880s were located just west of the high school. Sketchy information indicates that the Colchester (No. 2) Coal Member was about 30 inches thick at a depth of some 35-40 feet. The school is situated in a glacial sluiceway.
0.0	0.0	STOP (1-way); T-road intersection. TURN RIGHT (south) on Union Street.
0.2+	0.2+	CAUTION: Chessie System Railroad crossing (2-tracks). TURN RIGHT (west) just beyond the tracks on to Hazel Court and then TURN LEFT (south) on to Vine Street.
0.3-	0.5	STOP (1-way); T-road intersection. TURN RIGHT (west) on Fremont Avenue toward the state park.
0.35+	0.85+	TURN LEFT (south) on Ottawa Street.
0.2-	1.05	Cross Nettle Creek.
0.05-	1.1-	To the left is the entrance to Gebhard Woods State Park which lies along a segment of the Illinois-Michigan Canal. CONTINUE AHEAD AND BEAR RIGHT (southwest).
0.3+	1.4	To the left is the Illinois-Michigan Canal which is now in a state of disrepair here.

Miles to next point	Miles to starting point	
1.05	2.45	Mt. Carmel Cemetery on the right is situated on a sand and gravel ridge that extends some 2 miles southwest from Gebhard Woods. This ridge may have been a low island in ancient Cryder Lake, as its upper part is 640-650 feet msl (mean sea level elevation). CONTINUE AHEAD (southwesterly).
0.4	2.85	To the right is a recently abandoned sand and gravel pit in the ridge. Refuse has been dumped into the open pit at the west end. Prepare to turn right just ahead.
0.35	3.2	CAUTION: T-road intersection. TURN RIGHT (north).
0.1	3.3	You are crossing the axis of the sand and gravel ridge. Just beyond the corncrib to the right, look toward the right (east-northeast) to see the back side of the open sand and gravel pit. CONTINUE AHEAD (north). For the next 0.75 mile you will cross the westward continuation of the glacial sluiceway noted at Morris High School.
0.45	3.75	CAUTION: Chessie System 2-track railroad crossing. CONTINUE AHEAD (north) to U.S. Route 6.
0.4	4.15	This little scarp we are ascending is the beach of ancient Cryder Lake.
0.7-	4.85-	STOP (2-way); crossroads, U.S. Route 6. CONTINUE AHEAD (north) onto gravel road.
0.5+	5.35	I-80 overpass.
0.3	5.65	Notice how dark the soils are in this area. Just beyond the farm on the left the soil is quite sandy and moves quite easily in the wind. See how the ditch is filling in with drifting soil. Ancient Lake Morris shoreline is about 0.75 mile to the west.
0.85	6.5	Cross Nettle Creek. CONTINUE AHEAD (northerly).
0.15	6.65	Cross ancient Lake Morris shoreline.
1.2	7.85	STOP (2-way); crossroads. CONTINUE AHEAD (north).
0.3-	8.15-	CAUTION: narrow culvert.

Miles to next point	Miles to starting point	
0.7+	8.85	STOP (2-way); crossroads. TURN LEFT (west) on blacktop.
0.15	9.0	About 0.5 mile to the right is a series of elongate sand and fine gravel ridges (collectively called Central Ridge) that extends from northeast to southwest for several miles; we will cross it up ahead soon.
1.0	10.0	We are starting to ascend the gentle slopes of this ridge. Notice that the soils here are more sandy than they are on either side of the ridge.
0.25+	10.25+	Crest of Central Ridge.
0.1-	10.35	STOP (2-way); crossroads, Scott School and Airport Roads. CONTINUE AHEAD (west) on Airport Road.
0.1	10.45	NOTE: to the left, the sand stringers near the bottom of the slope. This series of ridges of Central Ridge now is on our left and dies out about 1.5 miles to the southwest. To the right, in the distance, is the northern crest of the Marseilles Morainic System developed on the Ransom Moraine.
1.35	11.8	We are ascending the backslope of the Ransom Moraine. The topography is becoming more gently rolling, a swell and swale landscape that gets more pronounced to the west.
2.05+	13.85+	STOP (2-way); crossroads, Nettle Creek and Airport Roads. CONTINUE AHEAD (west) onto the gravel, Airport Road.
0.9	14.75+	CAUTION: jog at crossroads, La Salle and Airport Roads. JOG RIGHT AND THEN LEFT (west) and enter La Salle County.
1.0	15.75+	STOP (1-way); T-road intersection. TURN LEFT (south) on La Salle County Highway 25.
0.5	16.25+	TURN RIGHT (west) at T-road intersection.
1.0	15.75+	STOP (1-way); T-road intersection. TURN LEFT (south) on La Salle County 25.

Miles to next point	Miles to starting point	
0.5	16.25+	TURN RIGHT (west) at T-road intersection.
1.0+	17.3-	TURN RIGHT (north) at crossroad onto gravel.
0.2+	17.5	Notice the shallow depressions in the landscape in this vicinity. Drainage is inward toward these sags in the topography, creating some problems for farmers.
1.3	18.8	CAUTION: crossroad. CONTINUE AHEAD (north).
0.3	19.1	You are now crossing the crest of the Ransom Moraine here about 780 feet msl. The view to the left is down across the outer margin of the Ransom and across the Norway Moraine, the older, lower moraine of the Marseilles Morainic System; a very panoramic view, if the crops aren't too high.
0.3+	19.4+	STOP (2-way); angled crossroad. TURN RIGHT (northeast) on the blacktop of Telephone Road.
0.8	20.2+	STOP 1. DISCUSSION OF SOME GLACIAL END MORAINES OF WISCONSINAN AGE AND THE MORRIS BASIN FROM THE CREST OF THE RANSOM MORAINE ACROSS THE ROAD FROM THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY LONG LINES DEPARTMENT.
0.0	20.2+	Leave Stop 1 and CONTINUE AHEAD (northeasterly).
0.3	20.5+	STOP (2-way); crossroad. TURN LEFT (north).
0.15-	20.65	The roadcut, particularly on the right, shows the gravelly Yorkville Till. NOTE: this area contains an abundance of cobbles scattered around in the fields; they have been worked up to the surface by plows and frost action.
0.85	21.5	You are going over the crest of the moraine again and descending the frontal slope of the Ransom Moraine. Good panoramic view ahead across the Norway Moraine.
0.35	21.85	Yorkville Till exposed in the low roadcuts on both sides.
0.65	22.5	STOP (1-way); T-road intersection. CAUTION: a slight knoll to the left restricts visibility. TURN RIGHT (east) on U.S. 52.

Miles to next point	Miles to starting point	
0.65+	23.15+	To the left is a good deep ditch exposure of Yorkville Till.
0.35-	23.5	County Line Road; enter Kendall County. NOTE: just beyond County Line Road you will descend a sharp hill into a broad U-shaped valley—a meltwater channel that will be discussed at Stop 2. Look at the valley on both sides of the road.
0.35	23.85	Cross the small stream; compare its size to that of the valley.
0.1	23.95	Cross old Indian Treaty Boundary.
0.1	24.05	Ascend the east valley wall.
0.65	24.7	PREPARE to turn right.
0.2	24.9	TURN RIGHT (south) on gravel crossroad, Stephens Road.
0.75+	25.65+	CAUTION: narrow culvert with the sides unmarked.
0.25	25.9+	CAUTION: unguarded T-road intersection. TURN RIGHT (west) on White Willow Road.
0.15+	26.05+	CAUTION: narrow concrete bridge.
0.05-	26.1	STOP 2. DISCUSSION OF CENTRAL RIDGE, LAKE HISTORY, AND MELTWATER CHANNEL.
0.0	26.1	Leave Stop 2. CONTINUE AHEAD (southwesterly).
1.35+	27.45+	CAUTION: unguarded crossroads, White Willow and County Line Roads. TURN LEFT (south) for a mile and a half on a rough road.
1.25	28.7+	Good view to the right of the upper part of the Ransom Moraine.
0.25	28.95+	CAUTION: crossroad with only one stop sign. TURN LEFT (east) and enter Grundy County.
0.9	29.85+	STOP (3-way); crossroads, Nettle Creek and Minooka Roads. CONTINUE STRAIGHT AHEAD onto blacktop Minooka Road for 3½ miles.

Miles to next point	Miles to starting point	
1.0+	30.85+	CAUTION: guarded crossroads, Roods Road. CONTINUE AHEAD (east).
1.25-	32.1	CAUTION: T-road from left; Townhouse Road. CONTINUE AHEAD on Minooka Road.
1.15+	33.25+	CAUTION: narrow bridge over East Fork Nettle Creek. PREPARE to turn left.
0.1	33.35+	CAUTION: T-road intersection; Scott School Road. TURN LEFT (north).
1.0-	34.35	Re-enter Kendall County.
0.5	34.85	CAUTION: guarded crossroad. TURN RIGHT (east) on Hill Road.
0.75	35.6	CAUTION: cross culvert. The stream here is floored with Ordovician Galena Group limestone on both sides. There is not much cover over the limestone in this area. CONTINUE AHEAD (east).
0.75+	36.35+	STOP (1-way); T-road intersection. TURN LEFT (north) on Lisbon Road.
0.45-	36.8	Enter the village of Lisbon.
0.55	37.35	STOP (4-way); crossroads. Look to your left at the beautiful old stone house constructed of the Galena limestone. TURN RIGHT (east) on Joliet Road.
0.3	37.65	Good view to the right down across the Morris Basin.
1.3	38.95	To the right is a small quarry.
0.6	39.55	To the right is the large quarry pit of Central Limestone Company.
0.3+	39.85+	T-road intersection from right just west of the intersection with Route 47 curve. TURN RIGHT (south) on Quarry Road.
0.3	40.15+	STOP 3. CENTRAL LIMESTONE COMPANY.
0.0	40.15+	Leave Stop 3. CONTINUE AHEAD (south) on Quarry Road.

Miles to next point	Miles to starting point	
0.2-	40.35	STOP (1-way); T-road intersection. TURN LEFT (east) on White Willow Road.
0.5-	40.85-	STOP; 2-way crossroad. Intersection with Illinois Route 47. TURN RIGHT (south) to the south side of Morris.
1.0	41.85-	Re-enter Grundy County. This area is part of the old lake plain.
2.95	44.8-	Cross Lake Morris shoreline.
1.35+	46.15	Enter city of Morris.
0.25+	46.4+	Enter I-80 interchange. CONTINUE AHEAD (south) on Illinois Route 47.
0.3-	46.7	Cross I-80 overpass.
0.1	46.8	To the left are some spoil piles from an abandoned strip mine.
0.25	47.05	CAUTION: stoplight, Green Acres Drive and intersection with U.S. Route 6. CONTINUE AHEAD (south) on Division Street across a glacial sluiceway.
0.7	47.75	CAUTION: stoplight, Bedford Road and U.S. Route 6 junction to right. CONTINUE AHEAD STRAIGHT (south).
0.3	48.05	CAUTION: stoplight, High Street. CONTINUE AHEAD (south).
0.3	48.35	Cross railroad overpass.
0.1+	48.45+	CAUTION: stoplight, Benton Street. CONTINUE AHEAD (south).
0.15-	48.6	CAUTION: stoplight, North Street. CONTINUE AHEAD (south).
0.25	48.85	CAUTION: stoplight, Washington Street.
0.05+	48.9+	TURN LEFT (east) on East Illinois Avenue just before you get to the Illinois-Michigan Canal and the entrance to the Illinois River Bridge. You are going to go east for 3 blocks.

Miles to next point	Miles to starting point	
0.25	49.15+	TURN RIGHT (south) on Price Street toward William G. Stratton State Park. CAUTION: speed bumps as you enter the park area.
0.05	49.2+	Cross wooden bridge over Illinois-Michigan Canal. CONTINUE AHEAD (south and then west).
0.2-,	49.4	Parking area for William G. Stratton Park.
		STOP 4. LUNCH FOLLOWED BY DISCUSSION OF ILLINOIS-MICHIGAN CANAL and the Illinois Waterway.
0.0	49.4	Leave Stop 4 and CONTINUE AHEAD (westerly) on North River Road.
0.1-	49.5-	Leave West Entrance to Park. CONTINUE AHEAD under Route 47 bridge—road ahead is narrow and sinuous.
0.25+	49.75	CAUTION: beware of large trucks; Continental Grain Company barge terminal.
0.05+	49.8+	CAUTION: ascend steep hill and TURN RIGHT (north) on Calhoun Street and cross concrete bridge over the canal.
0.05+	49.85+	TURN RIGHT (east) on West Illinois Avenue.
0.3-	50.15	STOP (2-way); intersection with Illinois Route 47 (Division Street). CAUTION: TURN RIGHT (south), cross the Illinois-Michigan Canal and enter the narrow Illinois River bridge.
0.2-	50.35-	Midspan of Illinois River bridge.
0.6+	50.95	PREPARE to turn right.
0.1+	51.05+	CAUTION: stoplight. TURN RIGHT (west) on Pine Bluff Road.
0.5	51.55+	STOP (4-way); crossroad. Straight across from us is the operating plant and office of the Materials Service Morris Sand and Gravel Operation. TURN LEFT (south) on Dwight Road. As you turn, look to your right out across the water, which is the result of the dredging of sand and gravel from Pleistocene valley train deposits. Most of the material produced is taken by barge into Chicago.

Miles to next point	Miles to starting point	
0.15-	51.7	The slope that you will ascend is the south valley wall of the Illinois River.
0.35+	52.05+	STOP (4-way); crossroads. TURN RIGHT (west) on Southmor Road.
0.3	52.35+	To the right you can see glimpses of the processing plant of Materials Service and the lake. Company barges and towboats carry the sand and gravel produced here into Chicago for construction purposes. This lake, which is connected to the Illinois River, is about 2 miles long. NOTE: Do NOT cross the fence if you stop and get out to look. The bank is unstable, there's no beach, and the water is deep.
0.7+	53.05+	T-road intersection from the left; a sign points to the Indian Creek Ranch. TURN AROUND and retrace your itinerary.
1.0-	54.05	STOP (4-way); Dwight and Southmor Roads. CONTINUE AHEAD (east) on Southmor Road.
0.5	54.55	STOP (2-way); crossroad, Route 47. CAUTION: CONTINUE AHEAD (straight).
1.0	55.55	CAUTION: guarded crossroad. TURN RIGHT (south) on School Drive and cross glacial sluiceway.
0.2	55.75	Good-sized cobbles are scattered across the fields on both sides.
0.2	55.95	South side of glacial sluiceway. The roadcut shows a mixture of sand and fine gravel. Boulders have been dumped here to help control erosion of the loose materials.
0.2	56.15	NOTE the flatness of the lake plain in this area.
0.15-	56.3-	TURN LEFT (east) on Southard Road.
0.3+	56.6	The two tall smokestacks to the northeast at 10 o'clock are located at the Collins Generating Plant of Commonwealth Edison Company.
0.2	56.8	NOTE: The fence rows in this area contain large numbers of boulders that have been pulled from the fields and stacked along them.

Miles to next point	Miles to starting point	
0.5	57.3	STOP (1-way); T-road intersection. TURN RIGHT (south) on Higgins Road.
0.75	58.05	TURN LEFT (east) on Oxbow Road.
0.75	58.8	The Cryder Lake shoreline cuts across this corner toward the southeast.
0.2+	59.0+	BEAR LEFT just ahead and drive along the top of the bank of the Mazon River. Down the slope to the right are many boulders and pieces of concrete; some have been dumped here to help control bank erosion.
0.2+	59.25-	CAUTION: T-road from right; Whitetie Road. TURN RIGHT (south) across the old bridge. Cryder Lake shoreline just touches the T-road intersection. NOTE: The old bridge is weak—therefore, allow 3 or 4 car lengths between vehicles. To the right, notice the large number of boulders on the south-facing bank of Mazon River below the road.
0.5+	59.75	CAUTION: road jogs to right around a meander loop of Mazon River.
0.6+	60.35+	STOP 5. SLUMP STRUCTURES ALONG MAZON RIVER.
0.0	60.35+	Leave Stop 5. CONTINUE AHEAD (east).
0.1-	60.45	T-road from right. CONTINUE AHEAD (east) on Whitetie Road.
0.25-	60.7-	To the left is a turn-off from which many slump features can be seen. Mazon River bends north here. The area to the northeast was strip mined for coal many years ago. CONTINUE AHEAD (east).
0.75+	61.45+	STOP (2-way); crossroads. TURN LEFT (north) on Jugtown Road.
0.3-	61.75	Jugtown Road cuts through part of the stripped over area.
0.3	62.05	We are coming into an area of mined land that has been developed for homes.
1.85	63.9	This area was part of a glacial sluiceway. Large swampy areas are on both sides of the road.

Miles to next point	Miles to starting point	
0.15-	64.05-	STOP (2-way); crossroad, Pine Bluff Road. CAUTION: fast cross traffic. CONTINUE AHEAD (north) toward Gooselake Prairie State Park.
0.4+	64.45	Many boulders are scattered across the area.
0.65-	65.1-	STOP (3-way); T-road from right. TURN RIGHT (easterly) and follow the road to the visitor's Center, Goose Lake Prairie State Park.
0.5	65.6-	BEAR RIGHT into the parking lot of Gunnar A. Peterson Visitor Center.
		STOP 6. DISCUSSION OF KANKAKEE FLOOD.
		Leave Stop 6 and retrace itinerary to Pine Bluff Road.
0.45+	66.05+	STOP (3-way); T-road intersection at entrance to Gooselake Prairie State Park. TURN LEFT (south) on Jugtown Road.
1.05+	67.15-	STOP (2-way); crossroads. TURN LEFT (east) on Pine Bluff Road.
0.25+	67.4	A budding country artist lives to the right of the road. Does the desert scene on the garage door indicate an intense desire to be in Arizona?
2.7+	70.1+	STOP (4-way); crossroads. TURN LEFT (north) toward the Dresden Power Station.
0.7-	70.8	The area to the left has been strip mined for clay—the Gooselake Clay, which is a Pennsylvanian clay probably the equivalent of the Cheltenham Fire Clay of Missouri. A. P. Green Refractories Company now operates the plant and recovers a good quality refractory clay. Associated lenticular coal bodies locally were of minable thickness. These beds occur below the No. 2 Coal. To the north, notice the boulders along some of these fence rows.
0.95	71.75	CAUTION: TURN RIGHT (northerly) at T-road intersection on curve toward the Dresden Power Plant.

Miles to next point	Miles to starting point	
0.1	71.85	Cross the cooling water ditches from the nuclear plant.
0.8-	72.65-	Enter the Dresden Power Station property of Commonwealth Edison. To the right at about 2 o'clock the high land across the river is the steep southern end of the Minooka Moraine.
0.35+	73.0	TURN RIGHT (east) into parking lot beyond the row of pine trees southeast of Administration Building and Tour Center.
		STOP 7. DRESDEN NUCLEAR POWER STATION TOUR CENTER, OWNED AND OPERATED BY COMMONWEALTH EDISON.
		NOTE: Tour Center is located behind and slightly to the right of the Administration Building. Go to Tour Center first. If no one is there, then go the Reception Desk on 2nd floor of Administration Building. In order to avoid disappointment, make arrangements for your visit beforehand: Tour Director, COMMONWEALTH EDISON, Dresden Nuclear Power Station, R.R. #1, Morris, Illinois 60450 (Phone: 815/942-2920, ext. 225).
0.0	73.0	Leave Stop 7 and retrace the itinerary to the south.
0.35+	73.35+	Leave the Dresden Power Station property.
0.8-	74.15-	Cross the power plant cooling ditches and PREPARE to stop.
0.1	74.25-	STOP (1-way); T-road intersection on curve. TURN RIGHT (northwesterly).
1.05+	75.3	General Electric Nuclear Fuel Reprocessing Plant on left was built about 20 years ago to reprocess fuel roads used in commercial nuclear power plants. The uranium-bearing fuel roads used in nuclear reactors must be replaced every couple of years because the fission product produced when the uranium decays reduces the efficiency of the rods. The plant was not successful in developing its recovery process, and never did reprocess any rods. The federal

Miles to next point	Miles to starting point	
		government also decided that reprocessing of fuel rods could not be done by commercial operators; hence, none of the plants built for this purpose were able to reprocess fuel for electric utilities. Since its completion, the G.E. plant has been used for the storage of spent fuel rods from nuclear power stations. The rods are stored in heavily constructed and carefully monitored pools of water. Eventually the rods will be transported to some other location for permanent storage or disposal.
0.1+	75.4+	CAUTION: cross railroad spur. CONTINUE AHEAD (northwesterly).
0.6-	76.0-	Access road to right to Dresden Island Lock and Dam, Corps of Engineers. CONTINUE AHEAD (west).
0.3+	76.3	The ditch and fields on either side are littered with fragments of Ordovician Divine Limestone. CONTINUE AHEAD (west).
0.2	76.5	TURN AROUND AND PARK just short of the Elgin-Joliet and Eastern Railroad crossing.
		STOP 8. DIVINE LIMESTONE (MAQUOKETA SHALE GROUP) OF ORDOVICIAN AGE EXPOSED IN LOW, WEST-FACING CUT OF EJ&E RAILROAD JUST SOUTH OF HIGHWAY CROSSING. CAUTION.
0.0	76.5	Leave Stop 8 and retrace itinerary southeasterly to Pine Bluff Road.
3.9	80.4	STOP (4-way); crossroads, Pine Bluff Road. CONTINUE AHEAD STRAIGHT (south). The erosional scarp just ahead is part of a glacial sluiceway.
0.25	80.65	Note to the right the large boulder pile.
0.6	81.25	The barn to the right was built on a sand dune. These Parkland Sand dunes are stablized with a forest cover.
0.5	81.75	To the right are very old strip mine spoil piles that have become densely overgrown.
1.65	83.4	CAUTION: narrow bridge across Claypool Ditch. Lake plain area.

Miles to next point	Miles to starting point	
0.2	83.6	Cryder Lake shoreline and area of Parkland Sand to south.
0.2	83.8	BEAR RIGHT (southwest and then west) and enter town of Eileen on North Street.
0.2	84.0	TURN LEFT (south); T-street intersection, North 5th Avenue.
0.1	84.1	CAUTION: guarded two-track railroad crossing, Atchison Topeka and Santa Fe (AT&SF). CONTINUE AHEAD (south).
0.1-	84.2-	CAUTION: guarded three-track railroad crossing, Illinois Central Gulf (ICG). CONTINUE AHEAD (south).
0.3+	84.5	STOP (1-way); T-street intersection, East Division Street. TURN LEFT (east) on Illinois Route 113.
0.15+	84.65+	You are entering the village of Diamond.
1.0-	85.65	Enter Will County.
0.15	85.8	Cross Cryder Lake shoreline.
0.5	86.3	CAUTION: enter I-55 interchange area. CONTINUE AHEAD (east).
0.15+	86.45+	Cross I-55 overpass. CONTINUE AHEAD (east).
0.15_	86.65	Crossroad. TURN RIGHT (south) toward Braidwood on Illinois 113 South. Note old slag piles scattered around the countryside from underground mining (in the early 1900s) in the longwall mining area of northeastern Illinois.
0.35	87.0	Cross Cryder Lake shoreline.
0.15-	87.15	CAUTION: enter Braidwood. Drive across lake plain of Lake Morris.
1.2+	88.35-	STOP (4-way); crossroads; 113 turns left. CONTINUE STRAIGHT AHEAD (south).
0.3-	88.65-	STOP (2-way); crossroads, Kennedy Road. CONTINUE AHEAD (south) on South Division Street.

Miles to next point	Miles to starting point	
0.45+	89.1+	STOP (2-way); angled crossroads, Illinois 129. CONTINUE AHEAD STRAIGHT (south). This is another area of Parkland Sand. CAUTION: cross unguarded one-track railroad (ICG).
0.05	89.15+	STOP (2-way); angled crossroad, Illinois 53.
0.3	89.45	CAUTION: ICG Railroad spur crossing. CONTINUE AHEAD (southwest).
0.4	89.85	CAUTION: enter hamlet of Godley.
0.5	90.35	PREPARE to turn left.
0.25-	90.6-	Angled crossroad. TURN LEFT (south) on Kankakee Street. This is the Will-Grundy County Line Road—the roughest road of the trip.
0.6+	91.2	To the left beyond the chain link fence is a dike that encloses the cooling lake for the Braidwood Nuclear Plant. CONTINUE AHEAD (south).
0.6	91.8	You are crossing a low dune of Parkland Sand. Note small grove of pine trees on it. Where the sand area has been plowed and the tree and/or sod cover has been broken, the sand has lost its protection and drifts easily across the road.
1.25	93.05	Crossroad at south end of cooling lake is on Will-Kankakee County Line. CONTINUE AHEAD (south).
0.5-	93.55-	Crossroad. CONTINUE AHEAD (south).
0.5+	94.05	Crossroad (W1900N, N500W). TURN LEFT (east). Road is very rough.
0.55	94.6	This is the area in which the service garage for the pit trucks of the old Northern Illinois Mine of Peabody Coal Company was located, just to the south across this little ditch. CONTINUE AHEAD (east).
0.35	94.95	STOP 9. COMMONWEALTH EDISON, PIT 11 (FORMERLY PEABODY COAL COMPANY, NORTHERN ILLINOIS MINE, PIT 11). This is the last stop on this field trip. You MUST have a pass from Commonwealth Edison to collect in the area to the north of this road.

* * * * *

TO LEAVE THIS LOCALITY:

1. Continue straight ahead for 1.1 miles; then:

   Go south (right) for 1 mile to the Essex-South Wilmington Road: Essex left.

   Go north for 1 mile and then east for another mile to Essex-Braidwood Road: Braidwood left to Illinois 113 or 53 and I-55.

2. Backtrack for 0.9 mile and then south 1 mile to Essex-South Wilmington Road; the latter is right. Then to Gardner and I-55 South.

PLEISTOCENE GLACIATIONS IN ILLINOIS

Origin of the Glaciers

During the past million years or so, the period of time called the Pleistocene Epoch, most of the northern hemisphere above the 50th parallel has been repeatedly covered by glacial ice. Ice sheets formed in sub-arctic regions four different times and spread outward until they covered the northern parts of Europe and North America. In North America the four glaciations, in order of occurrence from the oldest to the youngest, are called the Nebraskan, Kansan, Illinoian, and Wisconsinan Stages of the Pleistocene Epoch. The limits and times of the ice movement in Illinois are illustrated in the following pages by several figures.

The North American ice sheets developed during periods when the mean annual temperature was perhaps 4° to 7° C (7° to 13° F) cooler than it is now and winter snows did not completely melt during the summers. Because the cooler periods lasted tens of thousands of years, thick masses of snow and ice accumulated to form glaciers. As the ice thickened, the great weight of the ice and snow caused them to flow outward at their margins, often for hundreds of miles. As the ice sheets expanded, the areas in which snow accumulated probably also increased in extent.

Tongues of ice, called lobes, flowed southward from the Canadian centers near Hudson Bay and converged in the central lowland between the Appalachian and Rocky Mountains. There the glaciers made their farthest advances to the south. The sketch below shows several centers of flow, the general directions of flow from the centers, and the southern extent of glaciation. Because Illinois lies entirely in the central lowland, it has been invaded by glaciers from every center.

Effects of Glaciation

Pleistocene glaciers and the waters melting from them changed the landscapes they covered. The glaciers scraped and smeared the landforms they overrode, leveling and filling many of the minor valleys and even some of the larger ones. Moving ice carried colossal amounts of rock and earth, for much of what the glaciers wore off the ground was kneaded into the moving ice and carried along, often for hundreds of miles.

The continual floods released by melting ice entrenched new drainageways, deepened old ones, and then partly refilled both with sediments as great quantities of rock and earth were carried beyond the glacier fronts. According to some estimates, the amount of water drawn from the sea and changed into ice during a glaciation was probably enough to lower sea level more than 300 feet below present level. Consequently, the melting of a continental ice sheet provided a tremendous volume of water that eroded and transported sediments.

In most of Illinois, then, glacial and meltwater deposits buried the old rock-ribbed, low, hill-and-valley terrain and created the flatter landforms of our prairies. The mantle of soil material and the deposits of gravel, sand, and clay left by the glaciers over about 90 percent of the state have been of incalculable value to Illinois residents.

Glacial Deposits

The deposits of earth and rock materials moved by a glacier and deposited in the area once covered by the glacier are collectively called drift. Drift that is ice-laid is called till. Water-laid drift is called outwash.

Till is deposited when a glacier melts and the rock material it carries is dropped. Because this sediment is not moved much by water, a till is unsorted, containing particles of different sizes and compositions. It is also unstratified (unlayered). A till may contain materials ranging in size from microscopic clay particles to large boulders. Most tills in Illinois are pebbly clays with only a few boulders.

Tills may be deposited as end moraines, the arc-shaped ridges that pile up along the glacier edges where the flowing ice is melting as fast as it moves forward. Till also may be deposited as ground moraines, or till plains, which are gently undulating sheets deposited when the ice front melts back, or retreats. Deposits of till identify areas once covered by glaciers. Northeastern Illinois has many alternating ridges and plains, which are the succession of end moraines and till plains deposited by the Wisconsinan glacier.

Sorted and stratified sediment deposited by water melting from the glacier is called outwash. Outwash is bedded, or layered, because the flow of water that deposited it varied in gradient, volume, velocity, and direction. As a meltwater stream washes the rock materials along, it sorts them by size--the fine sands, silts, and clays are carried farther downstream than the coarser gravels and cobbles. Typical Pleistocene outwash in Illinois is in multilayered beds of clays, silts, sands, and gravels that look much like modern stream deposits.

Outwash deposits are found not only in the area covered by the ice field but sometimes far beyond it. Meltwater streams ran off the top of the glacier, in crevices in the ice, and under the ice. In some places, the cobble-gravel-sand filling of the bed of a stream that flowed in the ice is preserved as a sinuous ridge called an esker. Cone-shaped mounds of coarse outwash, called kames, were formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier.

The finest outwash sediments, the clays and silts, formed bedded deposits in the ponds and lakes that filled glacier-dammed stream valleys, the sags of the till plains, and some low, moraine-diked till plains. Meltwater streams that entered a lake quickly lost speed and almost immediately dropped the sands and gravels they carried, forming deltas at the edge of the lake. Very fine sand and silts were moved across the lake bottom by wind-generated currents, and the clays, which stayed in suspension longest, slowly settled out and accumulated with them.

Along the ice front, meltwater ran off in innumerable shifting and short-lived streams that laid down a broad, flat blanket of outwash that formed an outwash plain. Outwash was also carried away from the glacier in valleys cut by floods of meltwater. The Mississippi, Illinois, and Ohio Rivers occupy valleys that were major channels for meltwaters and were greatly widened and deepened during times of the greatest meltwater floods. When the floods waned, these valleys were partly filled with outwash far beyond the ice margins. Such outwash deposits, largely sand and gravel, are known as valley trains. Valley trains may be both extensive and thick deposits. For instance, the long valley train of the Mississippi Valley is locally as much as 200 feet thick.

Loess and Soils

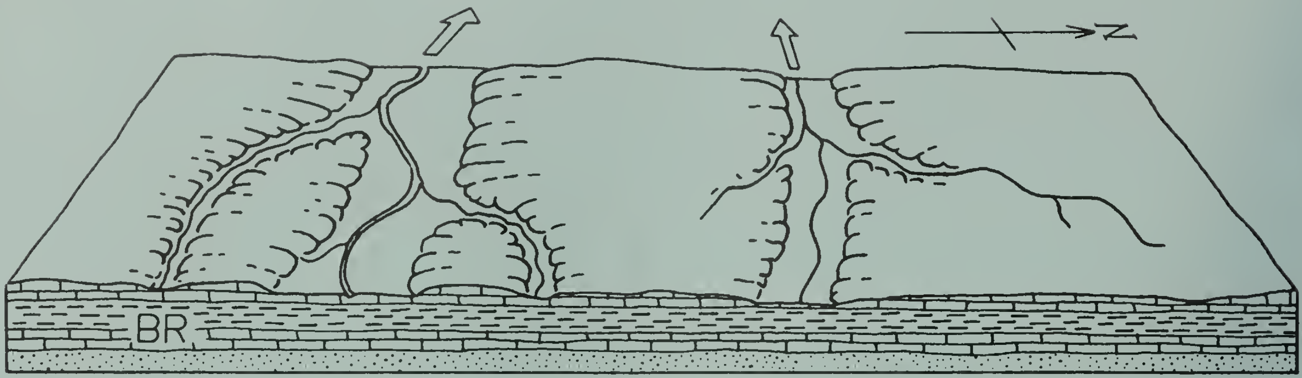
One of the most widespread sediments resulting from glaciation was carried not by ice or water but by wind. Loess is the name given to such deposits of windblown silt and clay. The silt was blown from the valley trains on the floodplains. Most loess deposition occurred in the fall and winter seasons when low temperatures caused meltwater floods to abate, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, west winds prevailed, and the loess deposits are thickest on the east sides of the source valleys. The loess thins rapidly away from the valleys but extends over almost all the state.

Each Pleistocene glaciation was followed by an interglacial stage that began when the climate warmed enough to melt the glaciers and their snowfields. During these warmer intervals, when the climate was similar to that of today, drift and loess surfaces were exposed to weather and the activities of living things. Consequently, over most of the glaciated terrain, soils developed on the Pleistocene deposits and altered their composition, color, and texture. Such soils were generally destroyed by later glacial advances, but those that survive serve as keys to the identity of the beds and are evidence of the passage of a long interval of time.

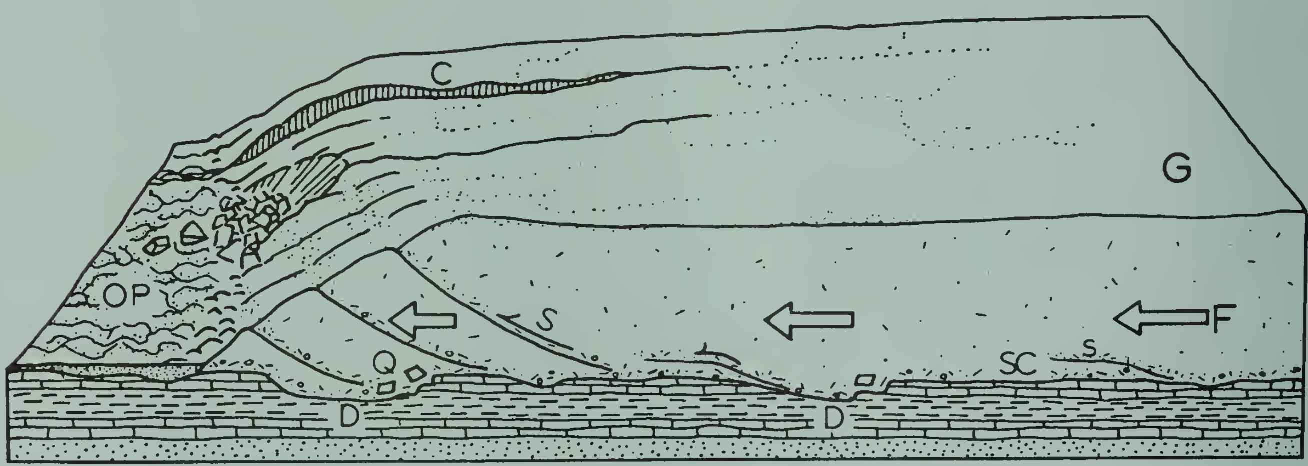
Glaciation in a Small Illinois Region

The following diagrams show how a continental ice sheet might have looked as it moved across a small region in Illinois. They illustrate how it could change the old terrain and create a landscape like the one we live on. To visualize how these glaciers looked, geologists study the landforms and materials left in the glaciated regions and also the present-day mountain glaciers and polar ice caps.

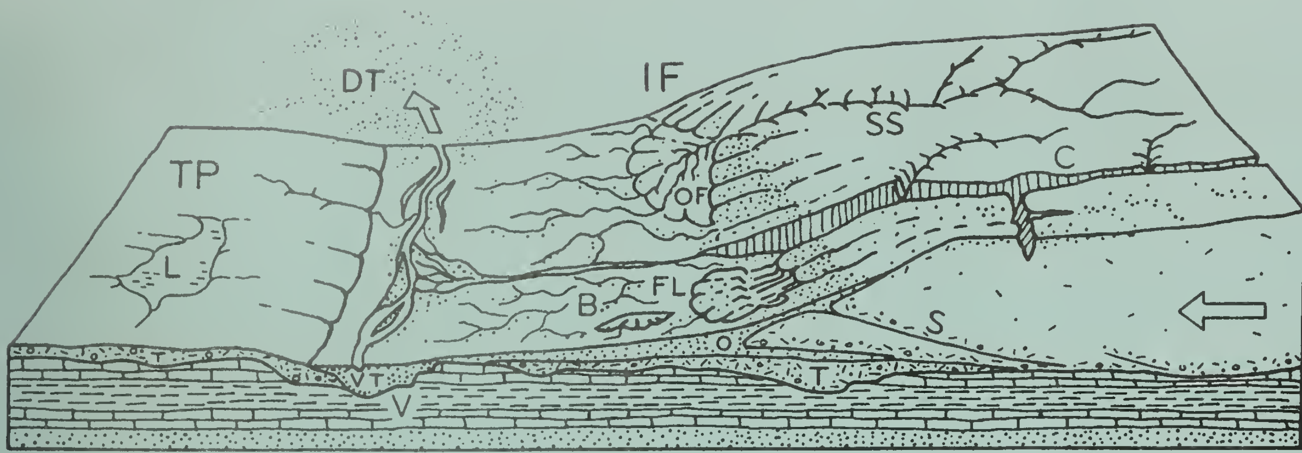
The block of land in the diagrams is several miles wide and about 10 miles long. The vertical scale is exaggerated--layers of material are drawn thicker and landforms higher than they ought to be so that they can be easily seen.



1. <u>The Region Before Glaciation</u> - Like most of Illinois, the region illustrated is underlain by almost flat-lying beds of sedimentary rocks--layers of sandstone ( ), limestone ( ), and shale ( ). Millions of years of erosion have planed down the bedrock (BR), creating a terrain of low uplands and shallow valleys. A residual soil weathered from local rock debris covers the area but is too thin to be shown in the drawing. The streams illustrated here flow westward and the one on the right flows into the other at a point beyond the diagram.



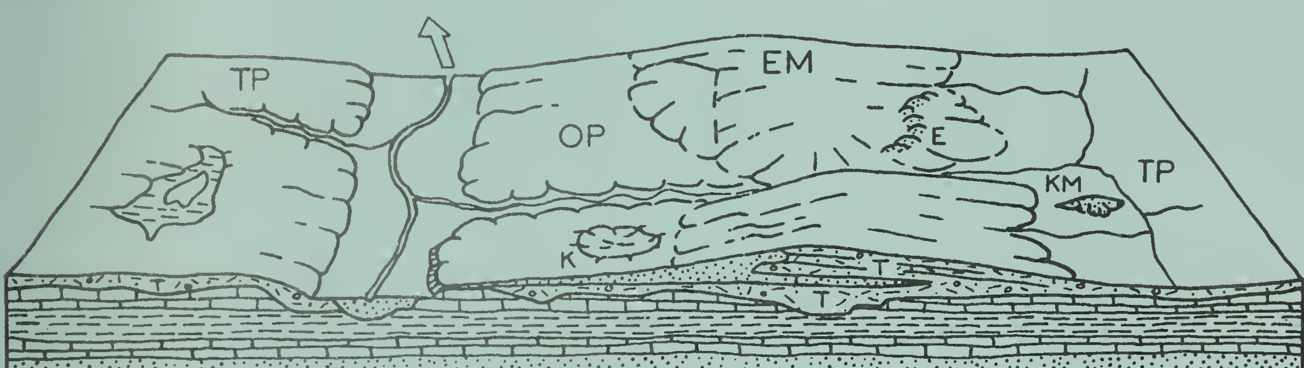
2. <u>The Glacier Advances Southward</u> - As the glacier (G) spreads out from its snowfield, it scours (SC) the soil and rock surface and quarries (Q)--pushes and plucks up--chunks of bedrock. These materials are mixed into the ice and make up the glacier's "load." Where roughnesses in the terrain slow or stop flow (F), the ice "current" slides up over the blocked ice on innumerable shear planes (S). Shearing mixes the load very thoroughly. As the glacier spreads, long cracks called "crevasses" (C) open parallel to the direction of ice flow. The glacier melts as it flows forward, and its meltwater erodes the terrain in front of the ice, deepening (D) some old valleys before the ice covers them. Meltwater washes away some of the load freed by melting and deposits it on the outwash plain (OP). The advancing glacier overrides its outwash and in places scours much of it up again. The glacier may be 5000 or so feet thick , except near its margin. Its ice front advances perhaps as much as a third of a mile per year.



3. <u>The Glacier Deposits an End Moraine</u> - After the glacier advanced across the area, the climate warmed and the ice began to melt as fast as it advanced. The ice front (IF) is now stationary, or fluctuating in a narrow area, and the glacier is depositing an end moraine.

As the top of the glacier melts, some of the sediment that was mixed in the ice accumulates on top of the glacier. Some is carried by meltwater onto the sloping ice front (IF) and out onto the plain beyond. Some of the debris slips down the ice front in a mudflow (FL). Meltwater runs through the ice in a crevasse (C). A superglacial stream (SS) drains the top of the ice, forming an outwash fan (OF). Moving ice has overridden an immobile part of the front on a shear plane (S). All but the top of a block of ice (B) is buried by outwash (O).

Sediment from the melted ice of the previous advance (figure 2) was left as a till layer (T), part of which forms the till plain (TP). A shallow, marshy lake (L) fills a low place in the plain. Although largely filled with drift, the valley (V) remained a low spot in the terrain. As soon as its ice cover melted, meltwater drained down the valley, cutting it deeper. Later, outwash partly refilled the valley--the outwash deposit is called a valley train (VT). Wind blows dust (DT) off the dry floodplain. The dust will form a loess deposit when it settles.



4. <u>The Region after Glaciation</u> - The climate has warmed even more, the whole ice sheet has melted, and the glaciation has ended. The end moraine (EM) is a low, broad ridge between the outwash plain (OP) and till plains (TP). Run-off from rains cuts stream valleys into its slopes. A stream goes through the end moraine along the channel cut by the meltwater that ran out of the crevasse in the glacier.

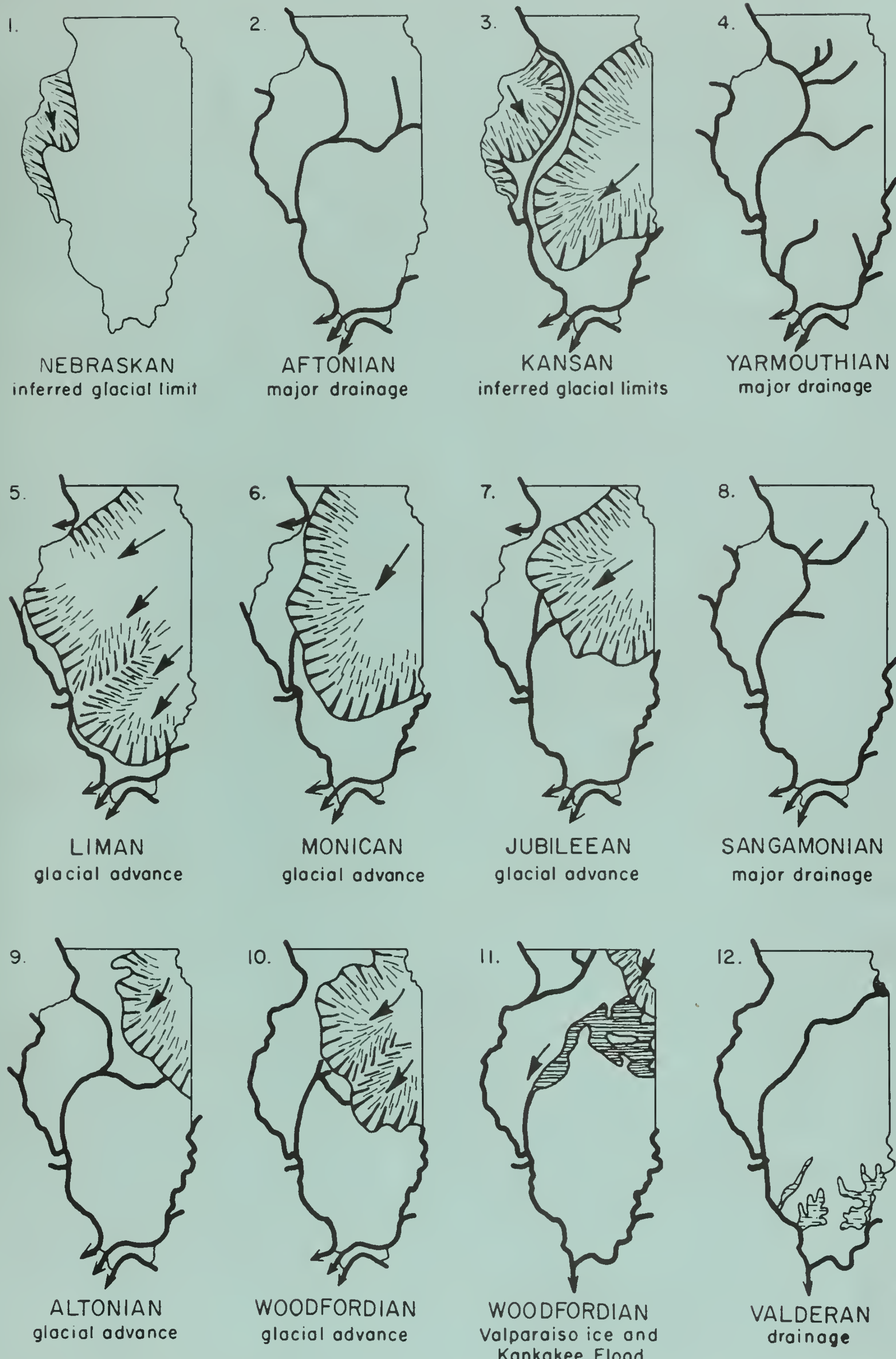
Slopewash and vegetation are filling the shallow lake. The collapse of outwash into the cavity left by the ice block's melting has made a kettle (K). The outwash that filled a tunnel draining under the glacier is preserved in an esker (E). The hill of outwash left where meltwater dumped sand and gravel into a crevasse or other depression in the glacier or at its edge is a kame (KM). A few feet of loess covers the entire area but cannot be shown at this scale.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	175,000		
ILLINOIAN (3rd glacial)	Jubileean	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
	Liman	Drift, loess	
	300,000		
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,200,000 or more		

(Illinois State Geological Survey, 1973)

SEQUENCE OF GLACIATIONS AND INTERGLACIAL
DRAINAGE IN ILLINOIS



(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)

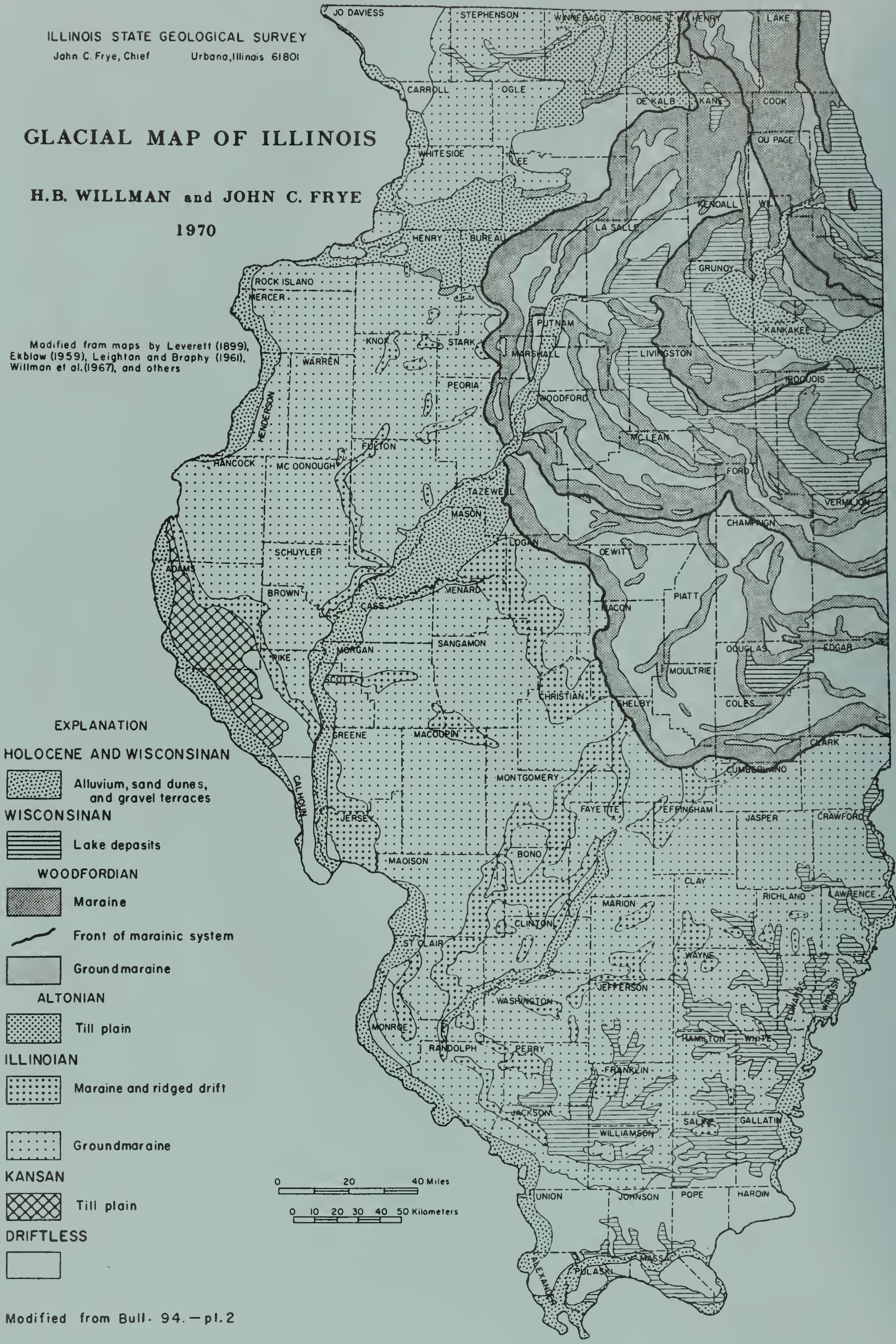
ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, Chief Urbana, Illinois 61801

GLACIAL MAP OF ILLINOIS

H.B. WILLMAN and JOHN C. FRYE

1970

Modified from maps by Leverett (1899), Ekblaw (1959), Leighton and Brophy (1961), Willman et al. (1967), and others



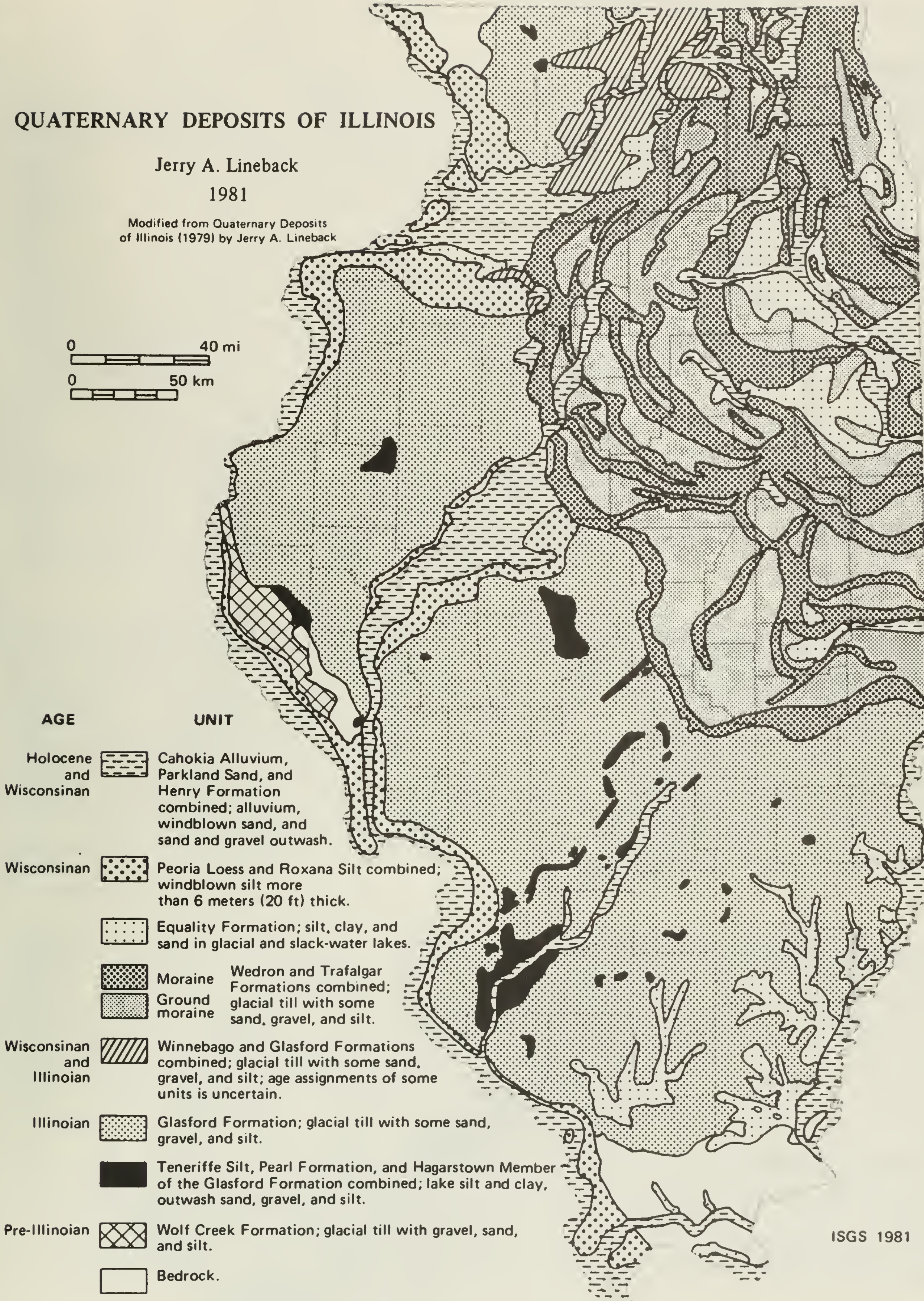
Modified from Bull. 94.—pl. 2

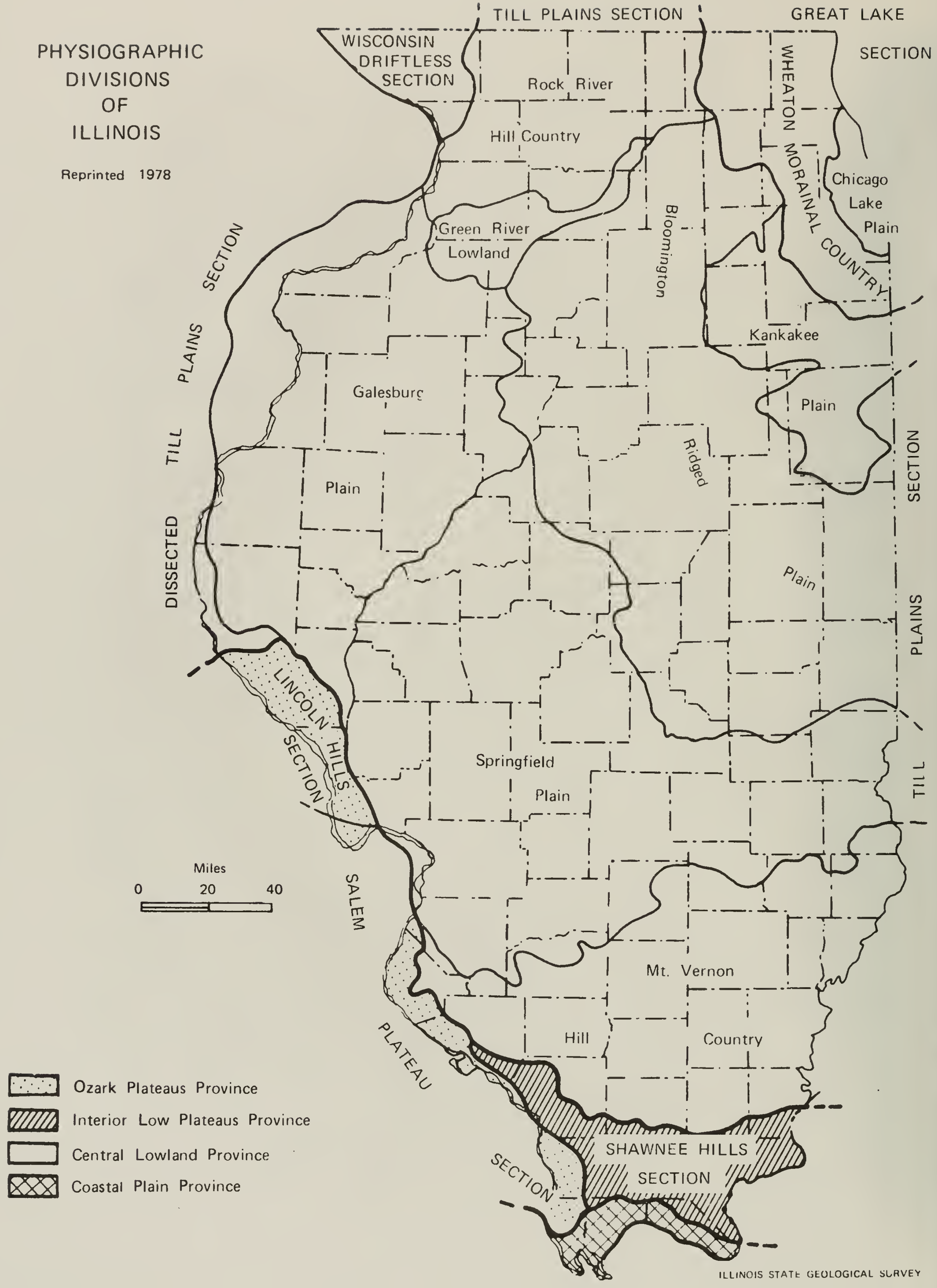
QUATERNARY DEPOSITS OF ILLINOIS

Jerry A. Lineback

1981

Modified from Quaternary Deposits of Illinois (1979) by Jerry A. Lineback




PHYSIOGRAPHIC DIVISIONS OF ILLINOIS
Reprinted 1978
TILL PLAINS SECTION
GREAT LAKE SECTION
WISCONSIN DRIFTLESS SECTION
Rock River
Hill Country
WHEATON MORAINAL COUNTRY
Chicago Lake Plain
Green River Lowland
Bloomington
DISSECTED TILL PLAINS SECTION
Kankakee
Plain
Galesburg
Plain
Ridged
Plain
TILL PLAINS SECTION
LINCOLN HILLS SECTION
Springfield
Plain
Miles
0 20 40
SALEM PLATEAU SECTION
Mt. Vernon
Hill
Country
SHAWNEE HILLS SECTION
Ozark Plateaus Province
Interior Low Plateaus Province
Central Lowland Province
Coastal Plain Province
ILLINOIS STATE GEOLOGICAL SURVEY

DEPOSITIONAL HISTORY OF THE PENNSYLVANIAN ROCKS

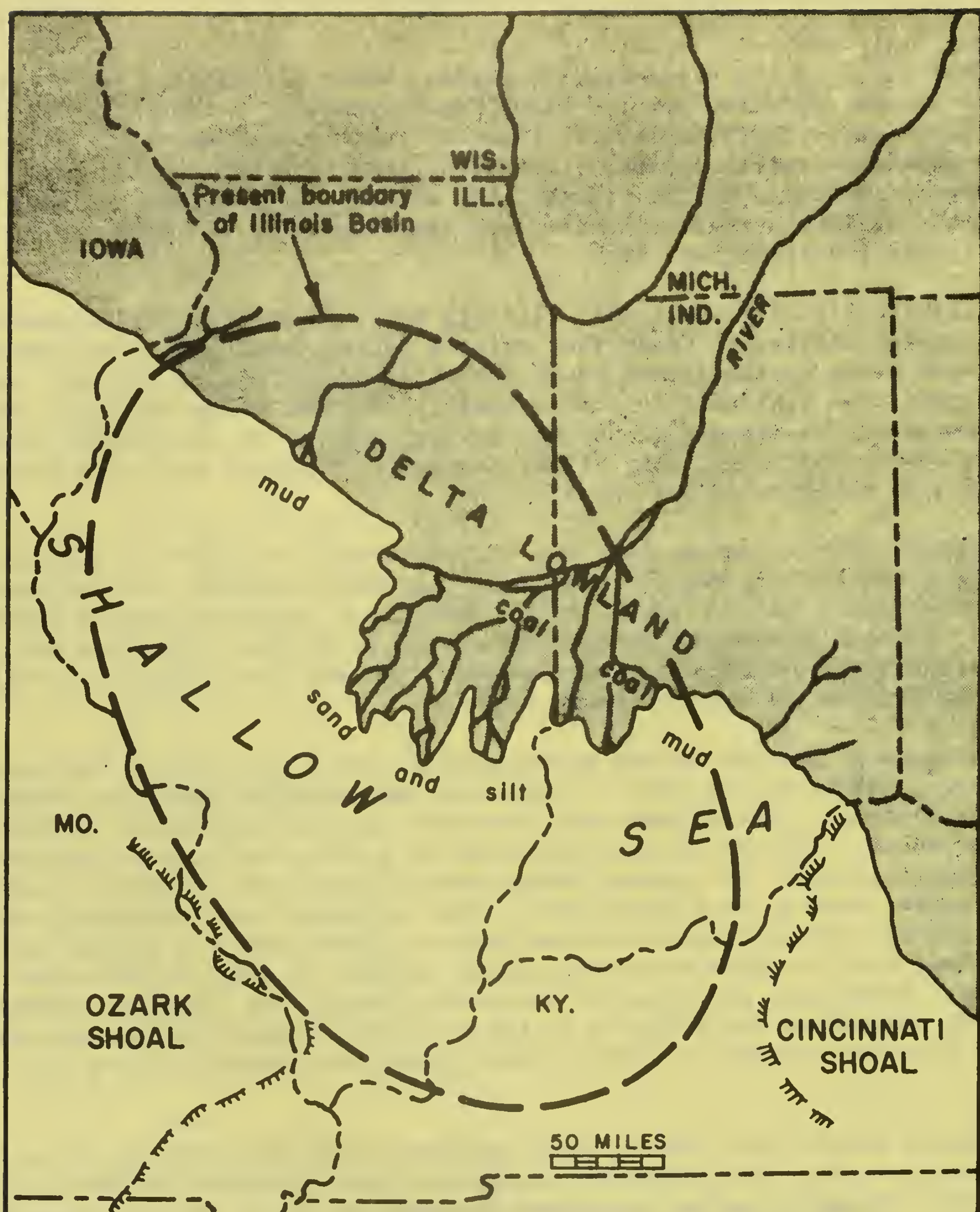
At the close of the Mississippian Period, about 310 million years ago, the Mississippian sea withdrew from the Midcontinent region. A long interval of erosion took place early in Pennsylvanian time and removed hundreds of feet of the pre-Pennsylvanian strata, completely stripping them away and cutting into older rocks over large areas of the Midwest. An ancient river system cut deep channels into the bedrock surface. Erosion was interrupted by the invasion of the Morrowan (early Pennsylvanian) sea.

Depositional conditions in the Illinois Basin during the Pennsylvanian Period were somewhat similar to those that existed during Chesterian (late Mississippian) time. A river system flowed southwestward across a swampy lowland, carrying mud and sand from highlands in the northeast. A great delta was built out into the shallow sea (see paleogeography map on next page). As the lowland stood only a few feet above sea level, only slight changes in relative sea level caused great shifts in the position of the shoreline.

Throughout Pennsylvanian time the Illinois Basin continued to subside while the delta front shifted owing to worldwide sea level changes, intermittent subsidence of the basin, and variations in the amounts of sediment carried seaward from the land. These alternations between marine and nonmarine conditions were more frequent than those during pre-Pennsylvanian time, and they produced striking lithologic variations in the Pennsylvanian rocks.

Conditions at various places on the shallow sea floor favored the deposition of sandstone, limestone, or shale. Sandstone was deposited near the mouths of distributary channels. These sands were reworked by waves and spread as thin sheets near the shore. The shales were deposited in quiet-water areas—in delta bays between distributaries, in lagoons behind barrier bars, and in deeper water beyond the nearshore zone of sand deposition. Most sediments now recognized as limestones, which are formed from the accumulation of limey parts of plants and animals, were laid down in areas where only minor amounts of sand and mud were being deposited. Therefore, the areas of sandstone, shale, and limestone deposition continually changed as the position of the shoreline changed and as the delta distributaries extended seaward or shifted their positions laterally along the shore.

Nonmarine sandstones, shales, and limestones were deposited on the deltaic lowland bordering the sea. The nonmarine sandstones were deposited in distributary channels, in river channels, and on the broad floodplains of the rivers. Some sand bodies, 100 or more feet thick, were deposited in channels that cut through many of the underlying rock units. The shales were deposited mainly on floodplains. Freshwater limestones and some shales were deposited locally in fresh-water lakes and swamps. The coals were formed by the accumulation of plant material, usually where it grew, beneath the quiet waters of extensive swamps that prevailed for long intervals on the emergent delta lowland. Lush forest vegetation, which thrived in the warm, moist Pennsylvanian climate, covered the region. The origin of the underclays beneath the coals is not precisely known, but they were probably deposited in the swamps as slackwater muds before the formation of the coals. Many underclays contain plant roots and rootlets that appear to be in their original places. The formation of coal marked the end of the nonmarine portion of the depositional cycle, for resubmergence of the borderlands by the sea interrupted nonmarine deposition, and marine sediments were then laid down over the coal.



Paleogeography of Illinois-Indiana region during Pennsylvanian time. The diagram shows the Pennsylvanian river delta and the position of the shoreline and the sea at an instant of time during the Pennsylvanian Period.

Pennsylvanian Cyclothems

Because of the extremely varied environmental conditions under which they formed, the Pennsylvanian strata exhibit extraordinary variations in thickness and composition, both laterally and vertically. Individual sedimentary units are often only a few inches thick and rarely exceed 30 feet thick. Sandstones and shales commonly grade laterally into each other, and shales sometimes interfinger and grade into limestones and coals. The underclays, coals, black shales, and limestones, however, display remarkable lateral continuity for such thin units (usually only a few feet thick). Coal seams have been traced in mines, outcrops, and subsurface drill records over areas comprising several states.

The rapid and frequent changes in depositional environments during Pennsylvanian time produced regular or cyclical alternations of sandstone, shale, limestone, and coal in response to the shifting front of the delta lowland. Each series of alternations, called a cyclothem, consists of several marine and nonmarine rock units that record a complete cycle of marine invasion and retreat. Geologists have determined, after extensive studies of the Pennsylvanian strata in the Midwest, that an ideally complete cyclothem consists of 10 sedimentary units. The chart on the next page shows the arrangement. Approximately 50 cyclothems have been described in the Illinois Basin, but only a few contain all 10 units. Usually one or more are missing because conditions of deposition were more varied than indicated by the ideal cyclothem. However, the order of units in each cyclothem is almost always the same. A typical cyclothem includes a basal sandstone overlain by an underclay, coal, black sheety shale, marine limestone, and gray marine shale. In general, the sandstone-underclay-coal portion (the lower 5 units) of each cyclothem is nonmarine and was deposited on the coastal lowlands from which the sea had withdrawn. However, some of the sandstones are entirely or partly marine. The units above the coal are marine sediments and were deposited when the sea advanced over the delta lowland.

Origin of Coal

It is generally accepted that the Pennsylvanian coals originated by the accumulation of vegetable matter, usually in place, beneath the waters of extensive, shallow, fresh-to-brackish swamps. They represent the last-formed deposits of the nonmarine portions of the cyclothems. The swamps occupied vast areas of the deltaic coastal lowland, which bordered the shallow Pennsylvanian sea. A luxuriant growth of forest plants, many quite different from the plants of today, flourished in the warm Pennsylvanian climate. Today's common deciduous trees were not present, and the flowering plants had not yet evolved. Instead, the jungle-like forests were dominated by giant ancestors of present-day club mosses, horsetails, ferns, conifers, and cycads. The undergrowth also was well developed, consisting of many ferns, fernlike plants, and small club mosses. Most of the plant fossils found in the coals and associated sedimentary rocks show no annual growth rings, suggesting rapid growth rates and lack of seasonal variations in the climate. Many of the Pennsylvanian plants, such as the seed ferns, eventually became extinct.

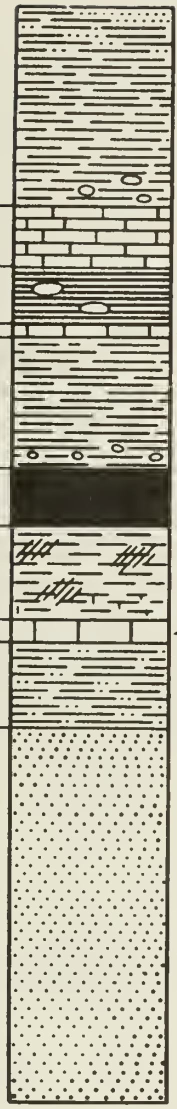
Plant debris from the rapidly growing swamp forests—leaves, twigs, branches, and logs—accumulated as thick mats of peat on the floors of the swamps. Normally, vegetable matter rapidly decays by oxidation, forming water, nitrogen, and carbon dioxide. However, the cover of swamp water, which was probably stagnant and low in oxygen, prevented the complete oxidation and decay of the peat deposits.

The periodic invasions of the Pennsylvanian sea across the coastal swamps killed the Pennsylvanian forests and initiated marine conditions of deposition. The peat deposits were buried by marine sediments. Following burial, the peat deposits were gradually transformed into coal by slow chemical and physical changes in which pressure (compaction by the enormous weight of overlying sedimentary layers), heat (also due to deep burial), and time were the most important factors. Water and volatile substances (nitrogen, hydrogen, and oxygen) were slowly driven off during the coalification process, and the peat deposits were changed into coal.

Coals have been classified by ranks that are based on the degree of coalification. The commonly recognized coals, in order of increasing rank, are (1) brown coal or lignite, (2) sub-bituminous, (3) bituminous, (4) semibituminous, (5) semianthracite, and (6) anthracite. Each increase in rank is characterized by larger amounts of fixed carbon and smaller amounts of oxygen and other volatiles. Hardness of coal also increases with increasing rank. All Illinois coals are classified as bituminous.

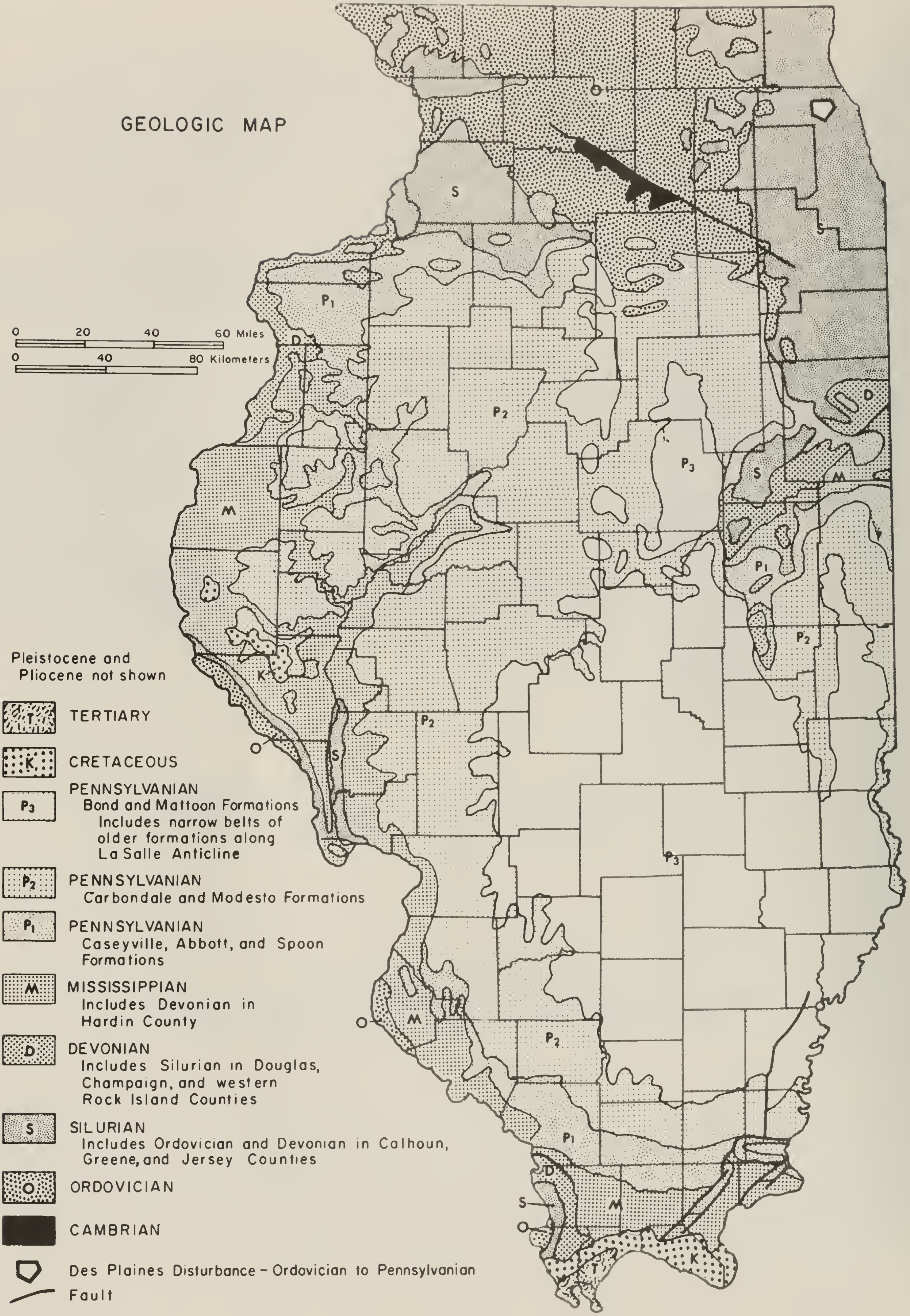
Underclays occur beneath most of the coals in Illinois. Because underclays are generally unstratified (unlayered), are leached to a bleached appearance, and generally contain plant roots, many geologists consider that they represent the ancient soils on which the coal-forming plants grew.

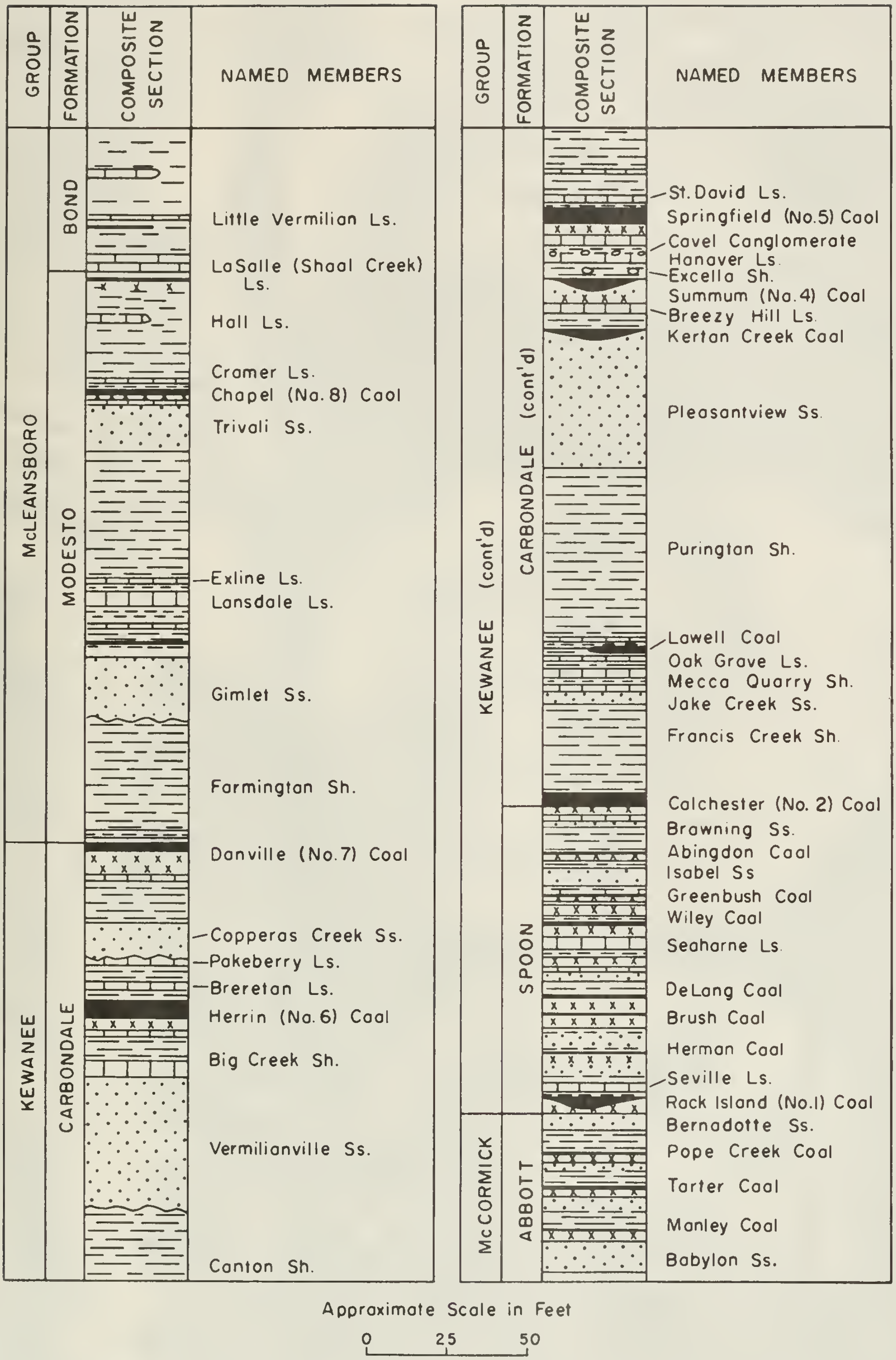
The exact origin of the carbonaceous black shales that occur above many coals is uncertain. The black shales probably are deposits formed under restricted marine (lagoonal) conditions during the initial part of the invasion cycle, when the region was partially closed off from the open sea. In any case, they were deposited in quiet-water areas where very fine, iron-rich muds and finely divided plant debris were washed in from the land. The high organic content of the black shales is also in part due to the carbonaceous remains of plants and animals that lived in the lagoons. Most of the fossils represent planktonic (floating) and nektonic (swimming) forms—not benthonic (bottom dwelling) forms. The depauperate (dwarf) fossil forms sometimes found in black shales formerly were thought to have been forms that were stunted by toxic conditions in the sulfide-rich, oxygen-deficient waters of the lagoons. However, study has shown that the "depauperate" fauna consists mostly of normal-size individuals of species that never grew any larger.



AN IDEALLY COMPLETE CYCLOTHEM

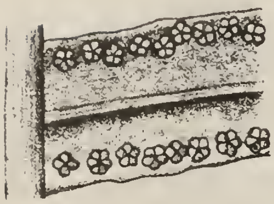
(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)


GEOLOGIC MAP
0 20 40 60 Miles
0 40 80 Kilometers
Pleistocene and Pliocene not shown
T TERTIARY
K CRETACEOUS
P3 PENNSYLVANIAN
Bond and Mattoon Formations
Includes narrow belts of older formations along La Salle Anticline
P2 PENNSYLVANIAN
Carbondale and Modesto Formations
P1 PENNSYLVANIAN
Caseyville, Abbott, and Spoon Formations
M MISSISSIPPIAN
Includes Devonian in Hardin County
D DEVONIAN
Includes Silurian in Douglas, Champaign, and western Rock Island Counties
S SILURIAN
Includes Ordovician and Devonian in Calhoun, Greene, and Jersey Counties
O ORDOVICIAN
CAMBRIAN
Des Plaines Disturbance - Ordovician to Pennsylvanian
Fault



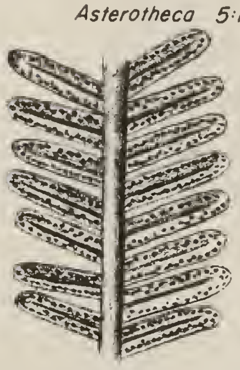
Generalized columnar section of Pennsylvanian strata in northern and western Illinois, modified from Smith, 1963, following Wanless, 1957.

FOSSIL PLANTS, FRANCIS CREEK SHALE

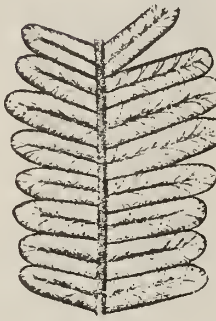


Asterotheca 5:1

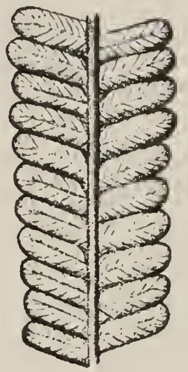
Pecopteris 5:1



Asterotheca sp. 1:1



Pecopteris sp. 1:1



Pecopteris unita 1:1

Pecopteris sp. 1:1

Neuropteris rarinervis 1:1

Neuropteris ovata 1:1

Sphenopteris sp. 1:1

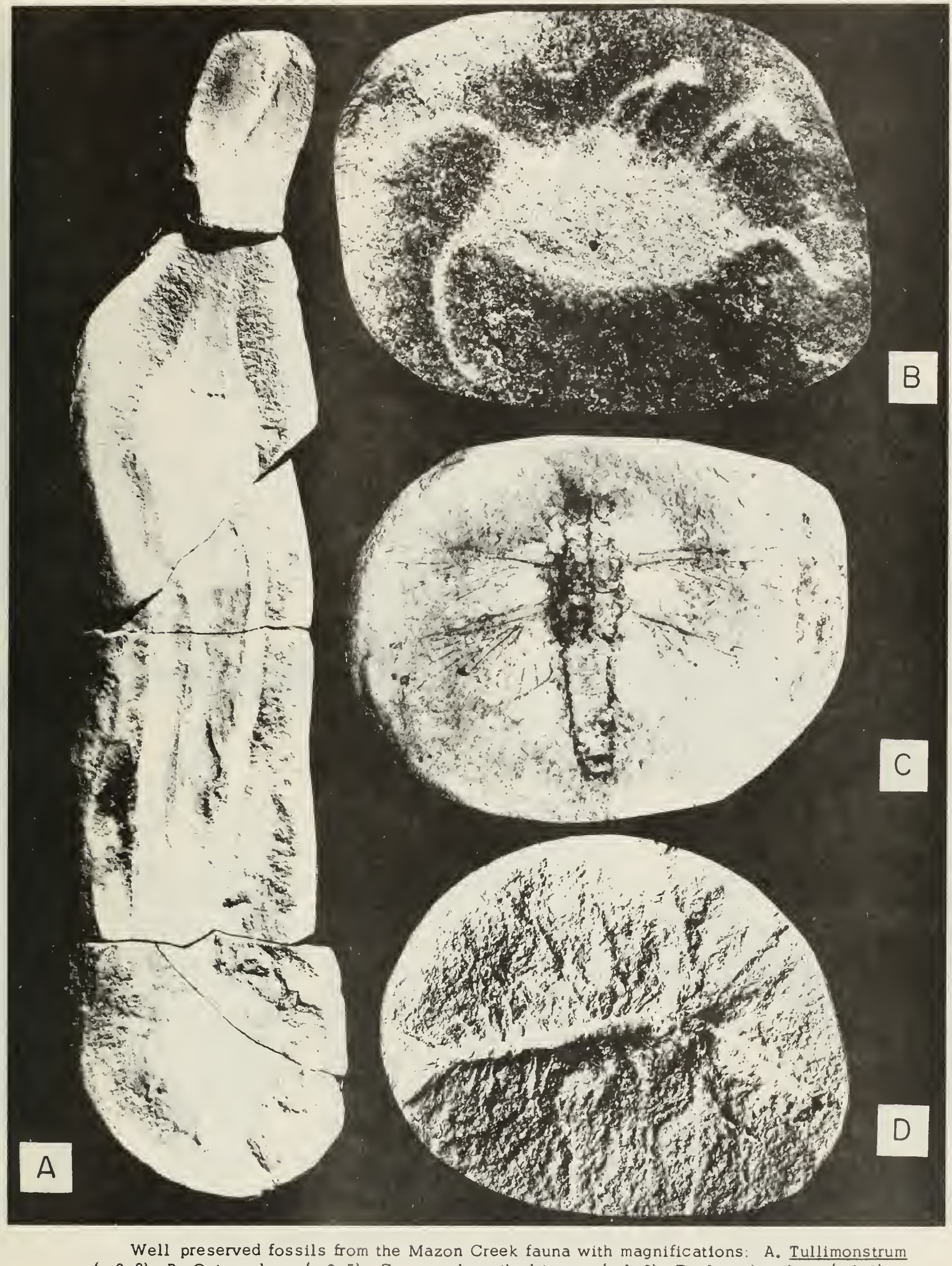
Sphenopteris sp. 1:1

Neuropteris scheuchzeri 1:1

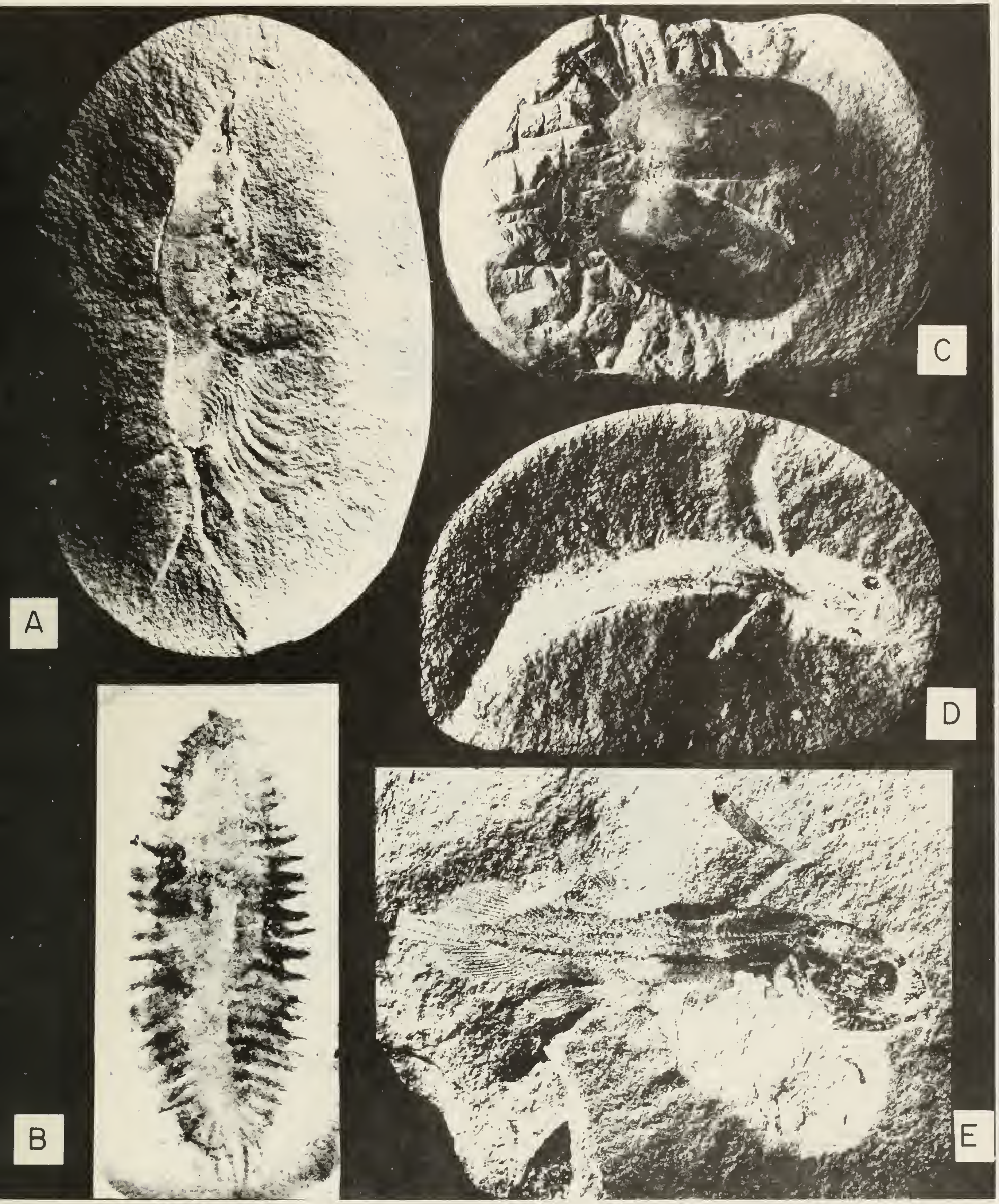
Sphenophyllum sp. 1:1

Alethopteris serlii 1:1

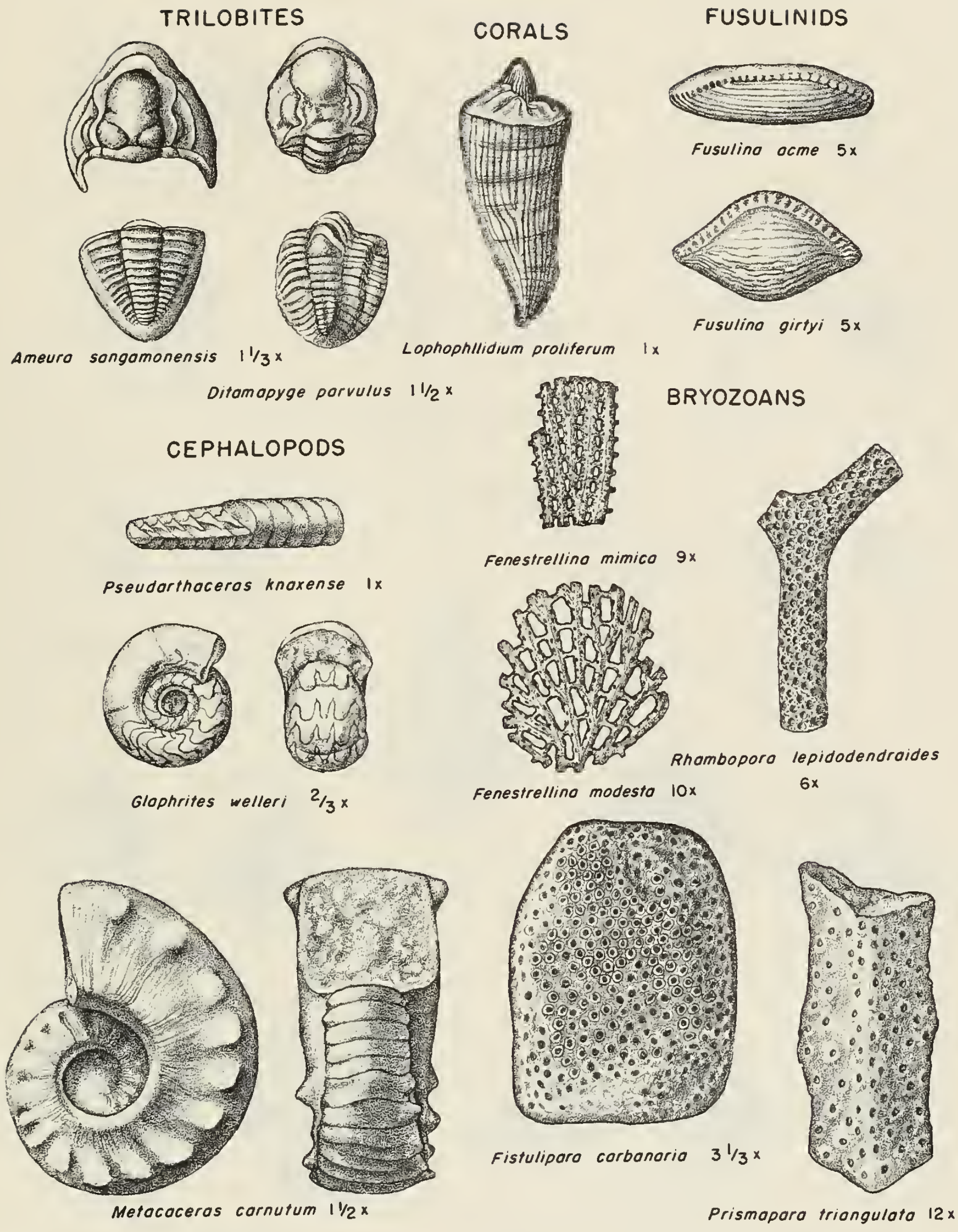
Mariopteris sp. 1:1



Well preserved fossils from the Mazon Creek fauna with magnifications: A. Tullimonstrum (x 0.8), B. Octomedusa (x 2.5), C. an undescribed insect (x 1.2), D. Acanthotelson (x 1.2).



Well preserved fossils from the Essex fauna with magnifications: A. Kallidecthes (x 1.2), B. an undescribed polychaete (x 1.6), C. a common bivalve (x 1.2), D. the "blade," possibly a larval amphibian (x 1.2), E. Rhabdodermis, a coelacanth (x 1.2).



TRILOBITES
CORALS
FUSULINIDS
Fusulina acme 5x
Fusulina girtyi 5x
Ameura sangamonensis 1 1/3 x
Lophophllidium proliferum 1x
Ditamapyge parvulus 1 1/2 x
BRYOZOANS
CEPHALOPODS
Pseudarthaceras knaxense 1x
Fenestrellina mimica 9x
Glaphrites welleri 2/3 x
Fenestrellina modesta 10x
Rhambopora lepidodendraides 6x
Fistulipara carbanaria 3 1/3 x
Metacaceras carnutum 1 1/2 x
Prismapara triangulata 12x

PELECYPODS

Nucula (Nuculopsis) girtyi 1x

Edmonia ovata 2x

Astartella concentrica 1x

Dunbarella knighti 1½x

Cardiomorpha missouriensis
"Type A" 1x

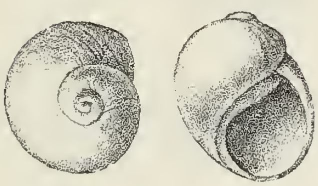
Cardiomorpha missouriensis
"Type B" 1½x

GASTROPODS

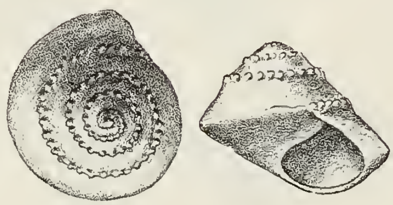
Euphemites carbonarius 1½x

Trepospira illinoisensis 1½x

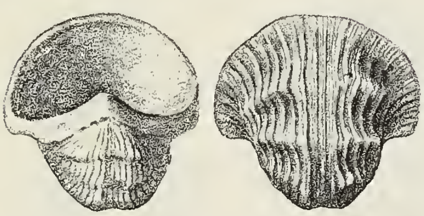
Donaldina robusta 8x



Naticopsis (Jedria) ventricosa 1½x



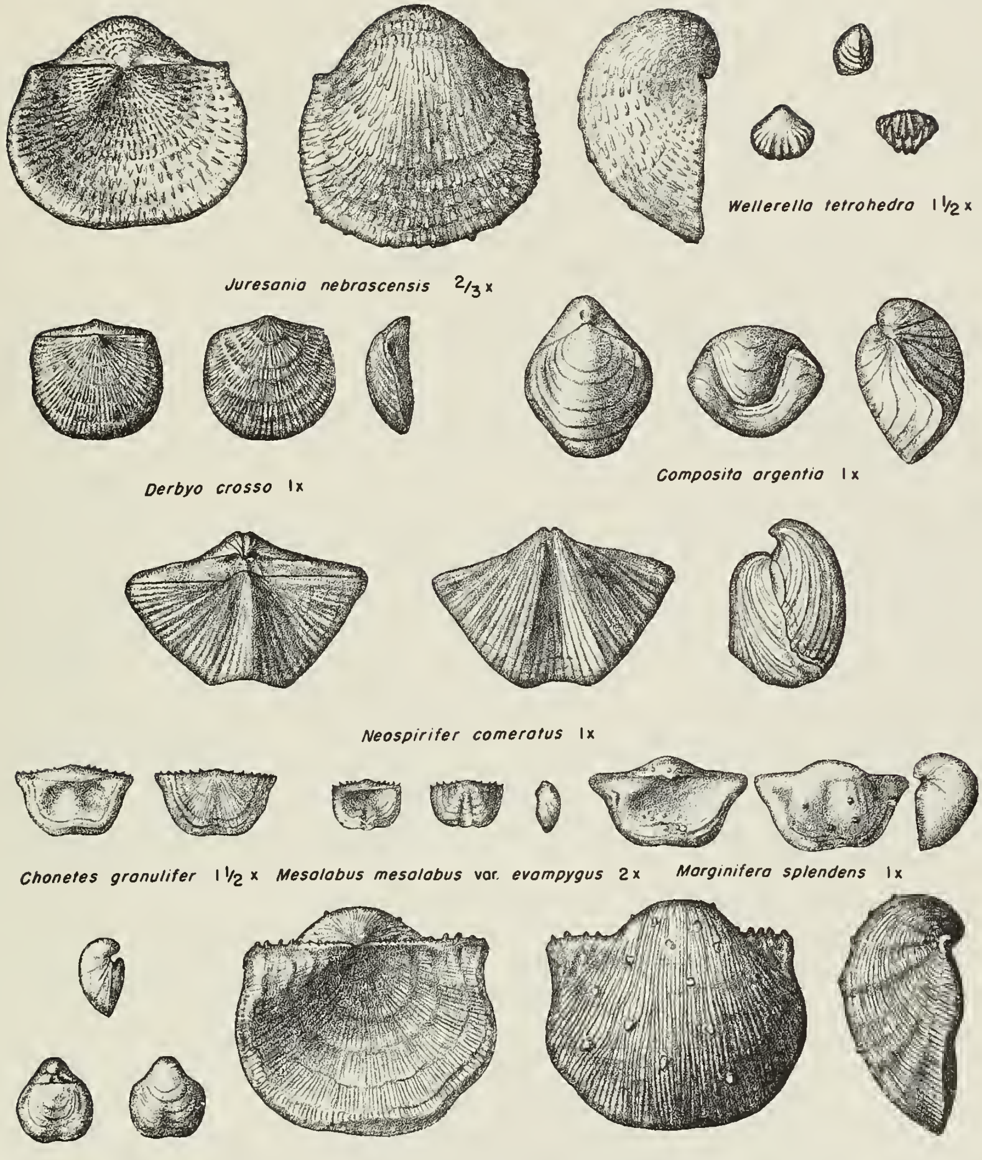
Trepospira sphaerulata 1x



Knightites montfortianus 2x

Glabrocingulum (Glabrocingulum) grayvillense 3x

BRACHIOPODS



Wellerella tetrahedra 1½ x

Juresania nebrascensis ⅔ x

Derbya crassa 1x

Composita argentia 1x

Neospirifer cameratus 1x

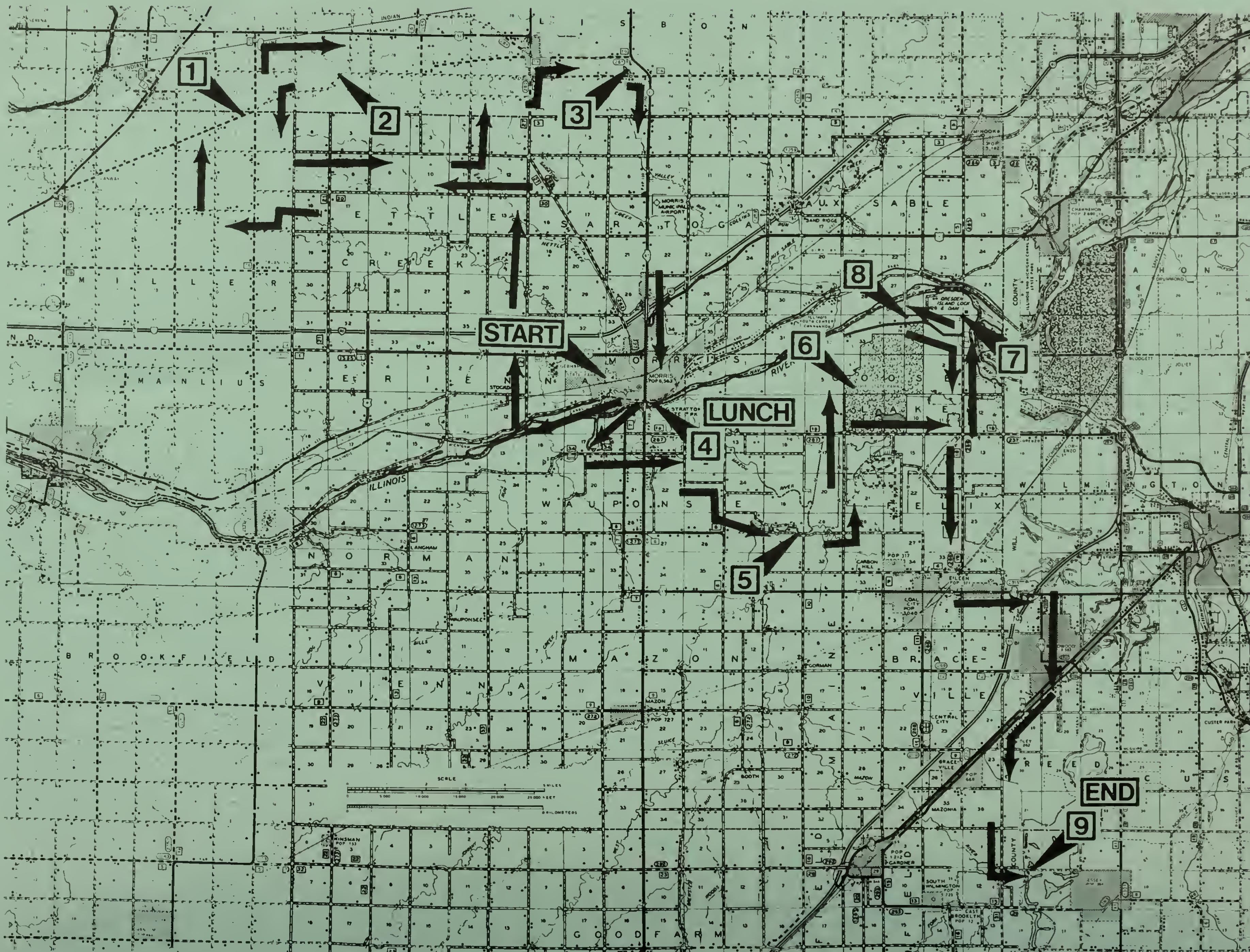
Chonetes granulifer 1½ x

Mesolobus mesolobus var. *euampygus* 2x

Marginifera splendens 1x

Crurithyris planoconvexa 2x

Linoproductus "cora" 1x


START
LUNCH
END
1
2
3
4
5
6
7
8
9
MORRIS
ILLINOIS
RIVER
MORRIS MUNICIPAL AIRPORT
SCALE
MILES
FEET
KILOMETERS